ELECTRICAL REVIEW

THE PIONEER ELECTRICAL WEEKLY OF AMERICA

VOL. LII. No. 19. NEW YORK, SATURDAY, MAY 9, 1908. ISSUED WEEKLY

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NEW YORK
PUBLISHING OFFICE . . . . . 13-21 PARK ROW
CHICAGO
WESTERN OFFICE . . . . . FISHER BUILDING
BOSTON
NEW ENGLAND OFFICE . . . . . 95 MILK STREET
LONDON
EUROPEAN OFFICE, HENRY W. HALL, Manager, 42 OLD BROAD STREET, E. C.

TELEPHONE AND CABLE
TELEPHONE "21 Cortland." Private exchange to all Departments.
REGISTERED CABLE ADDRESS: "Electview." New York.

SUBSCRIPTIONS
One Year, United States $3.00
One Year, Canada 4.00
One Year, Foreign Countries 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each . . .25

ADVERTISING
CHANGES for advertisements should be in this office by *Friday noon* for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than *Monday noon* to assure publication in that week's issue.

Published weekly by the ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York. Charles W. Price, president and treasurer; Stephen H. Goddard, vice-president; H. S. Tuthill, secretary.

Entered at the Post Office at New York as second-class matter under the Act of March 3, 1879.

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CARELESS USE OF SCIENTIFIC TERMS.

The man with a scientific or technical training should be distinguished by the accuracy and care with which he employs his terms. The chief value of an accepted name is that it gives to the hearer or reader a perfectly definite idea of the quantity or thing referred to. It is unfortunate that carelessness or laziness on the part of those who speak and write too often leads to expressions which are indefinite, and, perhaps, inaccurate. Power, force and energy are three terms which are very frequently abused. But it is probable that the science of illumination just at this time suffers more than any other division of science. This results partly from carelessness on the part of those who use the terms, but also, to a large extent, is due to the large number of different expressions used to convey a common idea and to the variety of units employed which are designated by the same or similar terms. The candle-power, for example, may mean the unit in use in England or the one employed in this country, or it may be a translation of the corresponding French or German units; and too frequently when these translations are made, the English term is substituted for the foreign term without any correction being made in the numerical values. Entirely incorrect ideas may in this way be conveyed if those interested in the matter are not on their guard.

A particularly annoying instance of this is found in the variety of expressions employed to designate the intensity of illumination. We have in this country the expressions "foot-candle" or "candle-foot," either of which the author uses at his pleasure; and sometimes he will employ both in the same discussion. Then there is the "candle-metre," the corresponding unit for the metric system. Then there are the "Carcel-metre" and the "bougie-metre," both of which are used in France. In Germany the "Hefner-metre" and the "metrekerze" are both used, depending upon the unit of luminous intensity employed, and there is still another unit used in this country, the "Hefner-foot," in order to link together the English system and measurements of illumination based upon the Hefner lamp. The existence of this large assortment of terms would in itself be sufficiently unfortunate, but when there is added to it the uncertainty mentioned above, that of knowing whether the author is using the proper term or has made due allowance for the numerical ratios existing between these different quantities, the situation becomes almost unbearable, and the immediate need for a common term, bearing but a single and definite value, is apparent.

Fortunately there is such a term which is rapidly coming into

use, since it has been accepted pretty generally. This is the "lux," which is the term used to express the intensity of illumination measured on the metric system. This makes the unit rather awkward for those using the English system of measurement, but that must be put up with by those who use the latter. It has been given as 10.8 times the foot-candle, the unit most commonly used in this country, although, as has been pointed out, the latter is an illogical expression, since the idea involves the quantity of light falling upon a given surface rather than the distance of that surface from the source of illumination. At the meeting of the International Photometrical Commission, which was held last summer, this matter came up for discussion, and in order to assist in straightening it out, a table of conversion ratios for the six units which have been mentioned was adopted. In this the lux is taken as the Hefner-metre, and the ratio to the candle-foot is 11.78 and not 10.8, the ratio which has been previously given, since the latter is based upon the old German "kerze," which is about 1.2 Hefner-kerze. Here again we find that even in the attempt to put the matter upon a definite basis a misunderstanding arises, as two values for the term "lux" have been given by different authors.

The best way out of this new difficulty ought to be to adopt the term in the sense employed by the Photometrical Commission, since this has now some authority, but it would seem advisable, for a time at least, for those who use the term to specify that it is this term which they are employing. When this is not done we will probably be worse off than we were before.

POSITIVE ELECTRICITY.

During the past few years we have been learning a lot about the corpuscle, or electron, as it is sometimes called, this being believed to be the smallest negative charge of electricity which can exist under the conditions which we have been able to impose in our various kinds of physical apparatus. This little individual, in spite of its minuteness, seems to lead a most exemplary life. It has certain rules of conduct up to which it lives, and it performs most valuable services in all of the electrical apparatus which are to-day so indispensable in modern life. It is indeed an example to be held up for emulation.

Now, accepting this idea of the existence of a negative quantity of electricity, and knowing that this makes its appearance at points where it was not previously recognizable, it is natural to conclude that at such times its presence was neutralized by the simultaneous presence of another kind of charge; in other words, by an equal positive quantity of electricity. Accepting this view, many have attempted to isolate the positive charge, but apparently without success. Positively charged bodies can be detected, but these apparently are nothing more than charged atoms. They are not, as the corpuscle seems to be, a much smaller body carrying a definite and permanent charge. This observation leads to the idea that the positive electron or corpuscle may exist, but it is attached to the molecule more tenaciously. That being the case, there ought to be some way of driving it out of its domicile and making it appear in public. The difficulty of doing this might at first be attributed to the inherent modesty of the positive corpuscle, but in a recent lecture on this subject, delivered by Dr. J. J. Thomson before the Royal Institution, of London, an entirely different reason is given. It seems that this body differs in character from the negative corpuscle, as well as in sign, for while the latter is methodical in everything, the former is erratic. In other words, it is just as mischievous as the negative corpuscle is industrious. It does things that are not expected of it, and appears in places where one would assume it had no business to be. And it is this unbecoming behavior, this objection to doing what is expected of it, that has made it so difficult to catch and tag properly.

These criticisms of the behavior of the positive corpuscles are based on a number of interesting experiments which were described by Dr. Thomson. Now, in looking for the negative electron, one naturally expects to find it between the two electrodes and starting from the cathode. Logically one would then look for its positive brother in the same place, but going in the other direction. The effects produced by it here might, however, be confounded with those due to the negative corpuscle; but assuming that the positive particle travels at a considerable speed, by piercing the cathode with a small hole it would seem probable that certain of these particles in their journey toward the cathode would pass through this opening and make their presence known beyond the latter. This has been done, and it has also been shown that the stream of particles thus passing through the cathode can be deflected both by magnetic and electric forces. When this is done it is noticed that there are apparently two positively charged bodies, one having a mass corresponding to the hydrogen atom, the other corresponding to the hydrogen molecule. This experiment shows nothing unusual, but if the polarity of the electrodes be reversed, positive particles will still be found back of what is now the anode, while one would naturally expect them to travel in the other direction. This is one of their eccentricities which must be explained. It has been found, moreover, that these particles would not be stopped by a positively charged gauze, even though it exerted a considerable retarding force. The charged gauze, it is true, would stop some of them, but apparently had no effect upon the velocity with which those which got through traveled. This, by the way, is a very respectable speed of about six hundred miles a second. To account for this behavior it is suggested that the speed of the positive particle is not due entirely to the electric forces acting upon it, since they have so little effect in stopping it. Therefore, it must be due to some internal commotion of the atom from which it starts, probably a volcanic explosion. The idea offered then is that these high-power projectiles are shot off toward the cathode, and as they approach it they take up a negative corpuscle which neutralizes them. The velocity and mass of the positive particle are so great, compared with the negative corpuscle, that this collision has slight effect upon its speed, hence it passes on through the opening in the cathode without the field set up by the latter being able to prevent it. Then as it issues on the far side at this terrific speed, it

throws away its corpuscle in the form of a negative charge, and proceeds the rest of the way on its own responsibility.

An interesting point is brought up by the apparent masses accompanying the positive charges. These, as has been said, correspond to hydrogen atoms and molecules. The idea at once occurs that these bodies are then simply hydrogen positively charged, either in the atomic or molecular state. Hydrogen is nearly always present everywhere, and might be expected to occur in these experimental tubes. Investigations on this point, however, lead to the conclusion that this is not the true explanation, for by an ingenious arrangement, by which he was able to separate the light from the heavy particles, Dr. Thomson found that the proportion between the two was practically independent of the nature of the gas with which the tube was filled. The evidence thus far secured indicates that there are no positive carriers corresponding in size to the negative corpuscle, but that the former apparently are comparable to the hydrogen atom. Moreover, two such atoms carrying a single charge may be associated. In fact, there seem to be still larger aggregations corresponding, as it were, to a combination of hydrogen. These results are suggestive of great possibilities, and it is to be hoped that further light will soon be thrown on this matter, as may be expected, since the investigation is being conducted by Dr. Thomson. It may be found that when we know more about it we shall be able to give the positive corpuscle a better character.

POSSIBILITIES OF ELECTRIC SMELTING.

An excellent view of the possibilities of electric smelting was given by Dr. A. Stansfield in a paper read recently before the Canadian Mining Institution. In this the author pointed out not only what had been done so far as actual production is concerned, but also other features which at times become more important than the actual cost of the process. At the present time actual smelting of iron in the electric furnace is not carried out because it can not compete with the blast furnace. In fact, even in the production of steel the cost is greater than the open-hearth process, but the product of the electric furnace is greatly superior.

Compared with the other forms of furnace, the electric furnace is still small. The capacity is about eight or ten tons of steel in the largest sizes, with a consumption of from 600 to 700 kilowatt-hours per ton of product. It seems worth while to point out here that the electric furnace is essentially a thermal furnace, and there is no electrolytic effect. In the Héroult type the arc is established between the electrodes and the molten slag, while in the induction furnace alternating current is used. The advantage of the furnace lies in the ability to secure the requisite temperature without introducing impurities. Moreover, control over the temperature is obtained. As an actual utilizer of heat, however, the electric furnace is much more efficient than the other type, even in its present state, and when it has been developed to a point where it is possible to save the heat losses now taking place, a much better showing will be made. Indeed, if the precautions taken to save the losses occurring in blast furnaces were applied to an electric smelting furnace, it might be found feasible to use the latter for the production of pig iron. Dr. Stansfield has made an attempt to determine what could be done in this way, and while he has not yet worked out the details of the furnace, he suggests a general method of construction. The idea is to utilize the heat of the waste gases coming off from the smelting chamber, the common monoxide contained being burned for heating the materials fed into the furnace. In doing this it is necessary to avoid heating the coke so that this can not be mixed with the other materials until later in the process. He computes that with a furnace working on this principle, one ton of pig iron can be obtained from an average ore by the use of two-tenths of a horse-power year and from six to eight hundred pounds of coke or charcoal. A reasonable allowance for heat loss has been made, and a further allowance for irregularity in the use of electric power. From these figures it may be said that with a proper furnace one-quarter of a horse-power-year will save about two-thirds of a ton of coke. Thus an electrical horse-power-year at $12 corresponds to coke at $4.50 a ton.

Assuming that this process could be carried out successfully, there yet remains the final step of producing steel directly from the ore. There are, of course, many difficulties to be overcome, but it is highly desirable that the price of steel should not be so great compared with that of cast iron, and it naturally seems as though a single continuous process will avoid many of the losses which now necessarily take place when the work has to be done twice.

AMERICAN ELECTROCHEMICAL SOCIETY.

The thirteenth general meeting of the American Electrochemical Society, which was held at Albany, Schenectady and Troy the latter part of last week, was most successful. In spite of the large number of papers presented, the meetings were so conducted that there was fifteen minutes to spare at the close of the last business session—a unique experience for this society. Certain of the papers were of exceptional interest, in particular that by the retiring president, Professor C. F. Burgess, who gave some very valuable results of an investigation of the corrosion of iron as affected by previous mechanical treatment. The social features were also well arranged, and the visiting members had not only a very profitable, but a thoroughly enjoyable, time.

THE LATEST WIRELESS ADVANCE.

One of the daily newspapers of New York city gives a brief account of what purports to be an important advance in wireless transmission. This states that two gentlemen at Omaha have constructed a locomotive driven by power from a wireless station. It is possible that the reporter confused the wireless transmission of driving power with the wireless control of a locomotive driven by power supplied through some other means. In either case the details should be interesting, and doubtless advance will be rapid, since it is stated in the same report that these two inventors have already "brought out a gasolene motor-car that has undergone constant improvement."

GENERAL ELECTRIC COMPANY.

ANNUAL REPORT FOR THE YEAR ENDED JANUARY 31.

The sixteenth annual report to the stockholders of the General Electric Company, for the year ended January 31, 1908, has been made public. President C. A. Coffin states that the past year has been one in which the energies of all the departments of the company have been taxed to their utmost, and in which the pressure upon the department heads has been particularly severe, and that the arduous and effective work done by them is worthy of the highest commendation. Mr. Coffin also says:

The profits of your company for the year ended January 31, 1908 (including $9,778.93 from securities sold, and $1,010,961.63 from royalties, dividends, bond interest, readjustment in Stocks and Bond Account, and Sundry Profits), after deducting all patent, general and miscellaneous expenses, and allowances for depreciation and losses, and writing off $3,745,989.06 from factory plants, were $6,586,653.37; paid in dividends during the year, $5,183,614.00; carried to surplus account, $1,403,039.37; surplus at the end of last fiscal year, $15,110,796.77; total surplus, January 31, 1908, $16,513,836.14.

Late in the year there was a sudden and severe shrinkage in the value of all merchandise and materials used by your company, notably copper. All said materials, whether raw, manufactured, or in process of manufacture, which were on hand January 31, 1908, were inventoried at the lower prices then prevailing. The book value of such inventories was thereby reduced by about $2,000,000.

In amount the Notes and Accounts Receivable were the largest in the company's history. Conservative valuation of these and the provision of liberal reserves against possible losses thereon, allowances for depreciation in factory plants and shrinkage in inventory values have greatly reduced profits.

During the year all the assets and liabilities of the Stanley-G. I. Electric Manufacturing Company, of Pittsfield, Mass., were taken over. Early in 1907, to provide for future development, an unencumbered fee of about 700 acres of land adjacent to the city of Erie, Pa., was purchased at a cost, including engineering and other expenses, of $232,301.53. In view of the existing depression the erection of buildings thereon is deferred for the present. The book value of the various securities included in the Stocks and Bonds account has been fixed at $18,000,089.85.

The report upon sales presented by Vice-President J. R. Lovejoy shows total sales billed of $70,977,168, and total orders received of $59,301,040. A comparison of five years is as follows:

Years Ending January 31.	Sales Billed.	Orders Received.
1903	$36,685,598	$39,944,454
1904	41,699,617	39,060,038
1905	39,231,328	35,094,807
1906	43,146,962	50,044,272
1907	60,071,883	60,483,659
1908	70,977,168	59,301,040

In the ten-year period ended January 31, 1908, Sales Billed have increased from $12,396,093 to $70,977,168, an average increase of 19.8 per cent per year. Sales Billed during the year 1907 increased 18.2 per cent over the previous year. Orders Received during the first six months of the fiscal year—February 1 to July 31, 1907—increased 22 per cent over the corresponding period of the year 1906. Owing, however, to the disturbed financial conditions prevailing during the latter part of the year, Orders Received for the second six months of the fiscal year decreased 23 per cent as compared with the previous year.

Since November last there has been a heavy decrease of Orders Received as compared with the past three years.

The total number of separate orders and contracts received during the year was 237,006, an average per week of 4,558.

The company has developed a 1,200-volt direct-current system, and two roads have been operating with entire success for several months. Equipment for several additional roads of this character is in process of installation.

The total number of Curtis turbines shipped to date (April 21) is 960, having a total capacity of 1,086,000 horse-power. Orders were received during the year for turbines aggregating 380,000 horse-power. There is now in process of manufacture for the Commonwealth Edison Company of Chicago and the New York Edison Company a number of turbine-generators of 14,000 kilowatts capacity each.

The report of Vice-President E. W. Rice, Jr., in charge of engineering and manufacturing departments, shows that expenditures aggregating $6,350,516.74 have been made during the year for real estate, erection of new factory buildings, additional machinery, patterns, special tools, fixtures, etc. The following details are given:

Schenectady Works—A building of 237,000 square feet floor area, used for the manufacture of large apparatus; a blacksmith and boiler shop of 39,000 square feet of floor space, an extension to the power-house of 18,000 square feet, a wood-working plant of 80,000 square feet, and an addition of 26,000 square feet for the manufacture of wire and cable, a total of 400,000 square feet of floor space, were completed during the year. A storehouse of 125,000 square feet and an addition to the porcelain factory of 45,000 square feet, authorized early in the year, have been completed. A building of 142,000 square feet for the manufacture of wiring devices, also authorized early in the year, is nearly completed.

Lynn Works—The building for the manufacture of stationary motors, of 170,000 square feet, was completed early last summer. A building of 99,000 square feet for the production of meters and instruments, and one of 71,000 square feet to be used as a carpenter shop, pattern shop and for pattern storage, are under construction.

Pittsfield Works—Buildings aggregating 230,000 square feet for the manufacture of transformers, lightning arresters, fan motors and switches, were completed during the year and are now in use. An iron foundry of 59,000 square feet of floor space is under construction and will be completed and in operation early the coming summer.

Lamp Works—The manufacture of incandescent lamps is now carried on at Harrison and Newark, N. J.; Ft. Wayne, Ind., and Toledo, Ohio. Increased floor space aggregating 195,000 square feet has been provided during the year, and buildings of 92,870 square feet of floor space are now under construction and will be completed within the next four months.

The total land area at all the works above described is now about 515 acres.

Our single-phase alternating-current railway equipments have been greatly improved during the past year.

Our new direct-current railway motor has proved so satisfactory in practical operation that it is rapidly being adopted as the standard type. It marks an important advance in economy and durability.

We have extended the range of economical operation of direct-current railway apparatus by designing it for use at 1,200 volts, about double the existing standard, and have sold a number of such equipments to the Southern Pacific Railroad Company.

We have sold to the Great Northern Railroad Company four 100-ton, three-phase electric locomotives designed to handle all trains traversing the two and one-half miles of Cascade tunnel in Washington.

A gas-electric car which fully meets the requirements of steam railroad companies for service on branch lines has been perfected. The equipment consists of a gasolene engine driving an electric generator which furnishes current to standard railway motors.

The report of Henry W. Darling, treasurer, and Edward Clark, general auditor, shows that during the year there was expended in acquiring sundry patents, for licenses under patents, and in patent

litigation, $872,345.67. This amount has been charged to profit and loss, leaving the company's patents, franchises and goodwill standing at a nominal valuation of $1, the same as at January 31, 1907. The report continues:

FACTORY PLANTS.

This account represents the Real Estate (lands and buildings); Machinery (steam and electric plants, tools, appliances, etc.); Patterns (including drawings, etc.); and Sundries (fittings and other small property accounts) of the manufacturing plants at Schenectady, N. Y.; Lynn, Mass.; lamp works at Harrison, N. J., and elsewhere, and Pittsfield, Mass. All are free from mortgage or other lien. On January 31, 1893, the book value of the first three mentioned factory plants was $3,958,528.21. During the fifteen years from that date to January 31, 1908, expenditures for land, buildings and additions to and replacement of machinery, fixtures, furniture, patterns, etc., including cost of acquiring the Pittsfield plant, have been made at a total cost of $30,892,485.72; total, $34,851,013.93. There has been written off during those fifteen years a total allowance for depreciation and replacement of $21,951,013.93; leaving their book value at January 31, 1908, $12,900,000.00, divided as follows: Schenectady works, $7,494,876.14; Lynn works, $3,360,067.06; lamp works, $905,056.80; total, $11,760,000.00; Pittsfield works, $1,140,000.00; grand total, $12,900,000.00.

COPPER MINING INVESTMENT.

This account represents the full amount invested in copper mining and milling properties at January 31, 1908, of which $1,129,961.63 is represented by capital stock, and $1,572,014.37 by advances. The principal property therein is that of the Bully Hill Copper Mining and Smelting Company, Winthrop, Shasta County, California, including an interest in a railway and valuable mills, which have recently been put in active operation.

The consolidated balance sheet as of January 31, 1908, is as follows:

ASSETS.

	1908.	1907.
Factory plants	$12,900,000	$9,000,000
Real estate	541,901	347,489
Discount paper	.....	666,607
Stocks and bonds	18,000,000	20,086,790
Cash	12,250,721	3,910,709
Notes and accounts receivable	29,857,727	25,786,464
Work in progress	1,276,294	3,853,321
Factory inventory	18,339,652	19,680,243
General and local office inventory	2,422,679	2,672,153
Consignment inventory	234,725	241,511
Copper mining investment	2,701,976	.....
Total	$98,525,765	$86,245,289

LIABILITIES.

Capital stock	$65,187,400	$63,572,800
Subscription to capital stock	.....	780,750
5% gold coupon debenture, 1892	55,000	55,000
5% gold coupon debenture, 1907	12,872,750	.....
3½% gold coupon debenture	2,047,000	2,047,000
Accrued interest	108,792	458
Accounts payable	1,759,517	4,010,410
Endorsements	.....	666,607
Unclaimed debenture liabilities	1,470	1,466
Profit and loss surplus	16,513,836	15,110,796
Total	$98,525,765	$86,245,289

BOOK REVIEWS.

"Simple Experiments in Static Electricity." Percival G. Bull. New York. Spon & Chamberlain. Paper. 68 pages. Illustrated. 5 by 7 inches. Furnished by the ELECTRICAL REVIEW for 25 cents.

This little treatise gives an elementary discussion of the phenomena of electrostatics; a large number of simple experiments, such as may be performed by the student with slight expense, being described.

"Locomotives of 1907." Charles S. Lake. New York. Spon & Chamberlain. Boards. 44 pages. Illustrated. 7 by 10 inches. Furnished by the ELECTRICAL REVIEW for 50 cents.

This is a supplement to the author's well-known treatise, "The World's Locomotives." With a view to keeping the latter up to date a supplementary book is published each year, the one in hand being that for 1907. In it are descriptions and the principal data of the most noteworthy locomotives built during that year. A considerable number of these are locomotives built in Great Britain for use in that country and elsewhere, but some French, German, Italian, Swedish and American engines are also described.

"Standard Wiring for Electric Light and Power." H. C. Cushing, Jr. New York. Published by the author. Flexible leather. 156 pages. Illustrated. 4½ by 6½ inches. Furnished by the ELECTRICAL REVIEW for $1.

This is the 1908 edition of this well-known handbook on electric wiring, it being the fourteenth edition. In it the work has been brought up to date so as to comply with the latest rulings of the Underwriters, thus giving the workman a reliable guide. For those who are not familiar with it, it may be said that it contains instructions for the installation of all types of electrical apparatus, wiring diagrams, rules for running circuits, tables for determining the size of wires, data sheets for standard apparatus, etc.

"Inventions." Frederick B. Wright. New York. Spon & Chamberlain. Paper. 108 pages. 5 by 7 inches. Furnished by the ELECTRICAL REVIEW for 25 cents.

In this little treatise the author tells the procedure which should be followed in order to obtain a patent in the United States, and he also gives some helpful suggestions for the protection, buying and selling of patents. A large number of problems which necessarily arise when an invention has been made are discussed, and the best methods of solving them are pointed out. It is not intended in this to furnish the inventor with a guide which will enable him to dispense with the patent attorney, but the object is rather to set him upon the proper path to enable him to secure full protection at the least expense.

Street Railways in Pennsylvania.

The annual report of the Bureau of Railways of the State Department of Internal Affairs of Pennsylvania shows that the street railways in Pennsylvania carried 87,935,058 more passengers in 1907 than in 1906, operated 690 more cars on 304 more miles of track, and paid $2,093,537 more in wages to 3,396 more employés. The total capitalization of street railways in Pennsylvania during the last year was $464,563,942. The income of the roads was $3,558,260 more than in 1906, and the disbursements $3,968,397 more. The total capitalization and current liabilities for the year amounted to $240,224,061, this being an increase of $56,570,620 over 1906. To this total capitalization must be added $224,329,881, which is the total capital stock and funded and unfunded indebtedness of companies leased and operated by other companies.

The New York Fire-Alarm System.

Once more the fire-alarm system in New York city has been severely condemned. Superintendent Martin, wire chief of the Fire Department, at a hearing before the Commissioners of Accounts on April 30, stated that the whole alarm system below Fifty-ninth street was likely to be rendered useless at any moment. Mr. Martin described the working of the system, its inauguration, and its history. He also explained how the system had been added to from time to time as the city's fire limits extended. He called attention to the fact that the system had never been designed for a city of New York's magnitude. The condition of the trunk lines below Fifty-ninth street, he said, was especially bad, particularly in and around police and fire headquarters.

The Chemical Engineers' Society.

A committee has been at work for some time obtaining the views of the chemists of the country with the idea of forming the American Institute of Chemical Engineers. It has been found that there is a strong sentiment in favor of bringing into closer relationship those men who more particularly specialize in chemical engineering. It has been decided to call a meeting for the purpose of organization. This meeting will be held in Philadelphia, Pa., some time during the middle of June. Several men eminent in the profession have consented to address the meeting. W. M. Booth, Dillaye Building, Syracuse, N. Y., may be called upon for further information.

THE CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

CHICAGO, ILL., MAY 19-22.

Arrangements have been about completed for the 1908 convention of the National Electric Light Association, which will be held at the Auditorium Hotel, Chicago, Ill., May 19-22. The secretary's office, registration and post-office, and the entertainment committee headquarters will be located on the parlor floor of the Auditorium. The exhibition committee will have headquarters in the exhibition hall on the ninth floor of the hotel. The general meetings will be held in the assembly hall, adjoining the exhibition hall. Special meetings will be held in the banquet hall on the sixth floor.

The following programme has been arranged:

TUESDAY, MAY 19, OPENING SESSION, TEN O'CLOCK.

President's address.

Announcements, by the secretary.

Report of Committee on Progress, T. Commerford Martin, New York.

Distribution in Suburban Districts, George H. Lukes, Chicago, Ill.

"Tape," Paul Lüpke, Trenton, N. J.

Report of Committee on Grounding Secondaries, W. H. Blood, Jr., chairman. Boston, Mass.

"Series Incandescent Lighting with Tungsten Lamps," P. D. Wagoner, Schenectady, N. Y.

AFTERNOON SESSION, TWO-THIRTY O'CLOCK.

"Observations on the Precision of Different Types of Photometer," Professor A. E. Kennelly and S. E. Whiting, Harvard University.

"Power Load Development for Central Stations of Moderate Size; Some Unappreciated Possibilities," Charles Robbins and J. R. Bibbins, Pittsburg, Pa.

"The Small Station and Its Economical Operation," J. T. Whittlesey, Newark, N. J.; Paul Spencer, Philadelphia, Pa.

Question Box, Alex. J. Campbell, editor, New London, Ct.

Report of Committee on Uniform Accounting, H. M. Edwards, chairman, New York city.

"Candle-Power Standard"—The presentation of resolutions toward the adoption of an international standard.

WEDNESDAY, MAY 20, MORNING SESSION, TEN O'CLOCK.

General Meeting.

Report of Committee on Gas Engines, W. C. L. Eglin, chairman, Philadelphia, Pa.

"Low-Pressure Steam Turbines," John W. Kirkland, Schenectady, N. Y.

Report of Committee on Meters, L. A. Ferguson, chairman, Chicago, Ill.

"Receiving Stations Operated from High-Tension Lines," S. Q. Hayes, Pittsburg, Pa.

Report of Committee on Organization Possibilities, Henry L. Doherty, New York city.

Special Meeting, banquet hall, sixth floor.

PARALLEL SESSION, TEN-FIFTEEN O'CLOCK.

Uniform Accounting and Its Details—Open to all accountants and others interested.

H. M. Edwards, chairman Committee on Uniform Accounting, will preside.

EVENING SESSION, EIGHT O'CLOCK.

Executive session.

Report of secretary and treasurer and executive committee.

Report of insurance expert, W. H. Blood, Jr., Boston, Mass.

Report of Committee on Public Policy, Arthur Williams, chairman, New York city.

"The Status and Commercial Possibilities of High-Efficiency Lamps," and discussion, W. W. Freeman, Brooklyn, N. Y.

Report of Committee on Rates and Costs, R. S. Hale, chairman, Boston, Mass.

Election of nominating committee.

THURSDAY, MAY 21—MORNING SESSION, TEN O'CLOCK—AFTERNOON SESSION, TWO-THIRTY O'CLOCK.

COMMERCIAL DAY.

C. W. Lee, chairman Programme Committee, New York city.

Henry L. Doherty, past-president, will preside during Commercial Day sessions.

1. Address—Relationship Between the Engineering and Commercial Departments, Louis A. Ferguson, past-president, Chicago, Ill.

2. Preparation for a Campaign:

(a) Field Work and Other Essentials.

(b) Analysis of Customers' Accounts.

(c) Proportion of Lamp Equivalent Lost to Lamps Connected—Showing Percentage in Cities of Varied Populations.

(d) Policy of Handling Complaints.

(e) Policy of Handling Collections.

Editor: H. J. Gille, Minneapolis, Minn.

3. The Contract Agent and the Representative:

(a) The Contract Agent—His Possibilities.

(b) The District Representative—His Possibilities.

(c) The Special Representative.

1—The Sign Expert.

2—The Power Expert.

3—The Woman Representative.

(d) Solicitors' Meetings — Their Objects.

Editor: V. A. Henderson, Memphis, Tenn.

4. The Display-Room:

(a) Appointments and Methods.

(b) Value of Special Demonstrations.

(c) Value of Electrical and Food-Show Exhibits.

Editor: L. D. Mathes, Dubuque, Iowa.

5. Advertising:

(a) What Is Being Done.

(b) Why?

(c) Results.

Editor: Charles A. Parker, Detroit, Mich.

6. Publicity:

(a) Methods to Create Proper Public Sentiment.

(b) Dormant Publicity Opportunities of Lighting Companies.

Editor: Percy Ingalls, Newark, N. J.

7. Creating Demand for Electricity:

(a) The Creative Principle.

(b) Notable Examples.

(c) Stereopticon Talk Upon Outline and Sign Lighting—Showing Progress in Large and Small Cities.

Editor: Frank B. Rae, Jr., New York city.

8. Evolution of New-Business Building:

(a) Examples of Central Stations That Have Continued Methods During Depression.

(b) Strong Plea for Upkeep of Commercial Departments and Advertising.

(c) Opportunities for Creating Business Along Existing Lines.

Editor: George N. Tidd, Scranton, Pa.

9. The Electrical Contractor:

Symposium:

(a) What He Is Doing to Assist in Creating Greater Demands for Electricity.

(b) Specific Examples.

Editor: Joseph F. Becker, Jr., Brooklyn, N. Y.

10. "Co-operative Commercialism," J. Robert Crouse, Cleveland, Ohio.

11. "Illuminating Engineering as a Commercial Factor"—Illustrated, V. R. Lansingh, New York city.

12. Report of Committee on Solicitors' Handbook Prize Award, John F. Gilchrist, chairman, Chicago, Ill.

13. Report of Committee on Co-operative Electrical Development, W. W. Freeman, chairman, Brooklyn, N. Y.

FRIDAY, MAY 22—MORNING SESSION, TEN O'CLOCK.

General Meeting.

"Illuminating Engineering," W. D'A. Ryan, West Lynn, Mass.

Report of Committee on Protection from Lightning and Other Static Disturbances, R. S. Stewart, chairman, Detroit, Mich.

"The Value of Care and Maintenance of Meters," H. D. King, Hoboken, N. J.

"Some Experiments in Combustion," S. J. Lenher, New York.

"Specifications for Construction on Joint Poles," Paul Spencer, Philadelphia, Pa.

Final Report of 1907 Committee to Consider Specifications for Street Lighting, W. D'A. Ryan, West Lynn, Mass.

Memorials, T. C. Martin, New York.

Executive session.

Election of officers for the ensuing year.

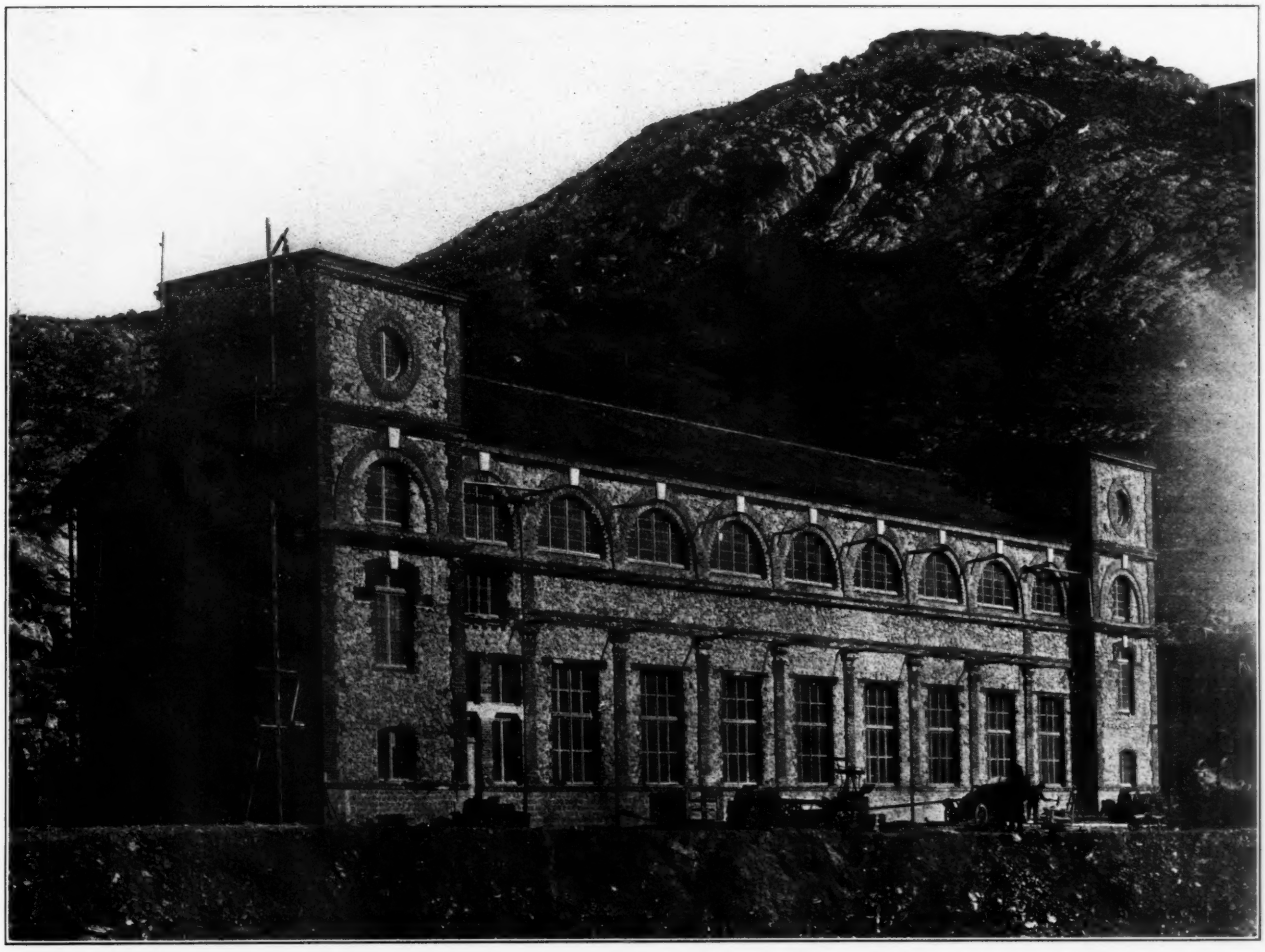
Master of Transportation George F. Porter announces that a special train of electrically lighted sleeping-compartment-observation and dining cars will leave New York *via* the Pennsylvania Railroad, foot of West Twenty-third street, 9.55 A. M.; Cortlandt street, 10 A. M.; Newark (Market street), 10.25 A. M.; Trenton, 11.15 A. M.; Philadelphia (Broad street), 12 noon; Pittsburg, 7.30 P. M. (Central time), on Sunday, May 17, arriving at Chicago, Ill., at 8.30 A. M., Monday, May 18.

New Plants in the Mediterranean Region.

SOME description has already been given of the extensive system of hydraulic plants, situated in the Alpine region of France lying near the Mediterranean coast, which supply current over a wide area of country. This network of pole lines and plants is at present the largest to be found on the Continent, and it is operated by the company known as the Energie Electrique. At present the lines extend from Monaco and Monte Carlo on the east, as far as Marseilles and Nice. The latter is arranged so that it can be operated in parallel with the network of pole lines.

The transformer station of Allauch is undoubtedly the largest which has been erected in Europe. It is located near the village of the same name and about seven miles from Marseilles. In this plant the three-phase current at 50,000 or 45,000 volts and twenty-five cycles, which is produced in the hydroelectric plants either completed or in construction upon the Siagne, the Durance and the Verdon rivers, which we have already mentioned, will be transformed into current of the same kind, but at the reduced tension of 13,500 volts for the supply of the region lying around Marseilles, where it is expected to dispose of a large amount of current. The primary current at 50,000 volts will be brought to the Allauch station by means of two overhead power lines. The lines which leave the station, working at 13,000 volts for the present district, will be erected at intervals according to the local needs. In order to provide for the 13,500-volt lines in the future, the station is laid out so that there will be starting points for twelve of these power lines.

As will be observed in the accompanying view of the exterior of the Allauch plant, it consists of a central building of considerable size, flanked by two towers, which receive the primary lines together with their lightning arresters and other accessories. The main part of the building measures 42.2 metres in length by 14.7 metres wide and has two stories. The ground floor is divided longitudinally into two commodious rooms for the heavy apparatus. One of these rooms, which lies next the front of the building, contains six compartments, each of which is designed to receive three large transformers. In front of these chambers there is a hallway in which a track is laid for the passage of the trucks used to convey the



EXTERIOR VIEW OF THE ALLAUCH SUBSTATION OF THE COMPAGNIE ENERGIE ELECTRIQUE.

Nimes on the west, and there are erected or in construction at present some ten large hydraulic plants representing a total of 60,000 horse-power. A number of these plants have been illustrated in former issues, and the present description will be devoted to the two newly erected stations; one, the large substation of Allauch, which is designed for the supply of Marseilles, principally over a sixty-mile pole line from the Brillanne hydraulic plant, and the other a steam-turbine plant installed at

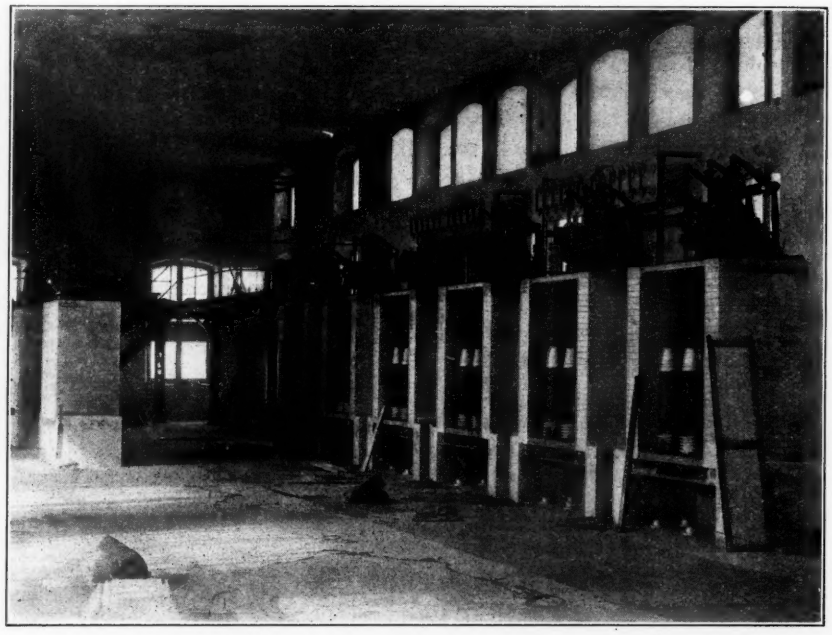
transformers. The second room in the rear is divided into two parts by a partition wall in the middle. One of the spaces which are thus formed contains the electric connections and the bus-bars, which work at 50,000 volts, while the second room contains the pumps for the water-cooling supply for the transformers. The water-piping which is used for this purpose is placed in an underground conduit which passes along the length of the building. In the north tower the ground floor is designed to contain a storage battery of large capacity which will soon be installed.

On the upper floor of the main building, which consists of a single large hall, are installed the lighter apparatus of the plant, comprising the main switchboard and the transformer circuits of high and low tension, including the lightning arresters. In the upper floor of each of the two towers there is placed a bridge from which can be operated the 50,000-volt switches. On the premises are erected a number of outbuildings which are used for various purposes, such as the superintendent's dwelling, a machine shop with traveling crane, a blacksmith's shop, store rooms and a testing laboratory.

In order to provide the water which is needed for cooling the transformers, etc., a reservoir of masonry has been built in the rocky hill overlooking the plant. It contains 500 cubic metres and lies at seven metres above the ground level of the main building. The height of the water in the reservoir is 3.5 metres, and above it is mounted a cooling apparatus which works on the atomizing principle. The water is taken from the Marseilles canal and is sent into the reservoir by means of motor-driven pumps which are installed at the side of the canal, and a pipe line of 1,600 metres length leads from this point to the reservoir.

Owing to the fact that high-tension wires of 50,000 volts are used here, it was necessary to have all the metal construction of the building covered, so as not to have any bare metal surface lying near the wires. In consequence, the main iron beams of the flooring and the columns which support them have been constructed of steel and then covered with a layer of cement. The brick flooring is laid with a special form of tubular brick which entirely covers the iron beams, and the whole is finished at the surface by a cement flooring. In this way all the metallic surfaces in the station are protected by a layer of at least twenty-five millimetres. It was also necessary to have a good protection of the instruments which are placed in the second floor against any leakage of water which might come from the breaking of the roof tiling, and to this end there is built an interior sloping roof of planks, with suitable means for carrying off the water. Each of the compartments or niches containing the transformers can be closed by a series of iron doors, so as to isolate the transformers in case of fire. The transformers, which weigh thirteen tons each, rest in the niches upon iron supporting rails and are slid into place in this way from the trucks, which have similar rails.

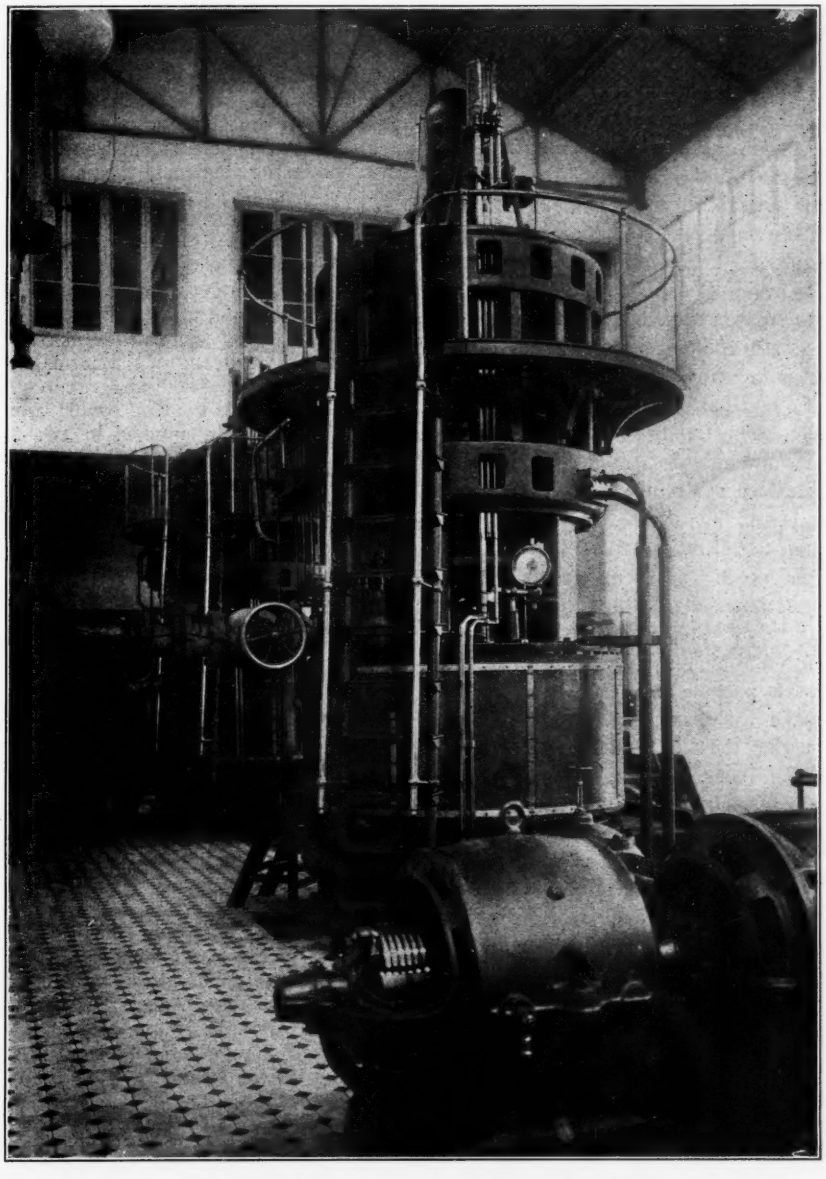
The transformers were constructed at the Paris works of the Compagnie Thomson-Houston. They are of the single-phase type with oil bath and water cooling. Each transformer has a capacity of 1,000 kilowatts and the ratio is at present 1 to 2. In this way, when they are connected on the delta system, using three transformers in a single group, they give a secondary voltage of 13,000 volts, in which case the primary circuit is supplied at 26,000 volts. The latter tension is to be used at first, but at a later period is designed to connect the transformers on



THE OIL-BREAK, MOTOR-OPERATED OIL SWITCHES, ALLAUCH SUBSTATION.

ALLAUCH SUBSTATION OF COMPAGNIE ENERGIE ELECTRIQUE, UNDER CONSTRUCTION.

the star system and use current at 45,000 volts, coming from the 15,000-horse-power hydraulic plant of Brillanne, which is located on the Durance River, lying at a distance of sixty miles in a northerly direction. This latter station is the most recent of the Mediterranean coast plants, and was set running only a few months ago.



Curtis Turbine Groups in the Risso Plant, Nice, France.

In the future the number of transformers in the Allauch plant will probably be increased to thirty-six, and these will be grouped so as to form two half-posts of similar design, each one of which will have a capacity of 18,000 kilowatts, but at present the plant is laid out for only one of these posts, using eighteen transformers. All the transformers were given a factory test in the cold for one minute at a tension of 30,000 volts between primary and secondary windings and between the primary and the mass, and at 25,000 volts between the secondary and the mass. A very efficient water-cooling system is used in this case. The piping of the water supply is fed by two turbine pumps operated by three-phase motors. Each of the pumps will deliver forty cubic metres per hour, and a single pump is sufficient to give the water supply for the eighteen transformers now installed, the second pump being used as a standby. The motors in this case are direct-coupled to the pumps and are of five horse-power, with squirrel-cage armature, supplied at 220 volts and twenty-five cycles by special transformers.

The main switchboard apparatus, which is located in the upper floor of the building, consists at present of the following panels: two panels for the high and low-tension circuits of the transformers, with one panel for three transformers; six panels for the starting point of the 13,000-volt secondary lines leaving the station, of which two panels are used for the underground feeders running to Marseilles, and four panels for the overhead lines of Pourrières, St. Maximin and Aubagne; one panel for coupling the 45,000-volt bus-bars, which allows of coupling or isolating the two overhead lines coming from the Brillanne hydraulic plant. Each of the above panels carries all the necessary measuring instruments (ammeter, voltmeter, with their current and potential transformers).

One of the characteristic features of the present plant is the exclusive use of three-pole switches of the oil type, for the 45,000-volt and the 13,000-volt circuits and upon the bus-bars. These switches are provided, with the exception of the switch upon the coupling panel, with time-relays which allow of an automatic cutoff in case of an overload for any considerable time. Pilot lamps, two for each of the switches, show the positions of opening and closing of the latter.

Great care has been taken in laying out the bus-bar system of the station. The 45,000-volt bars form but a single series, while the 13,000-volt bars are laid out in two series. The former bars are arranged so that a switch will allow of isolating or coupling the two main lines coming from the Brillanne plant, as above mentioned. Section-couplers allow of placing a greater or less number of transformers in the circuit, so as to carry out the repairs without danger and without stopping the service. The two series of 13,000-volt bus-bars are disposed so that later on they can be connected together so as to form a single circuit. By means of three-pole switches with double knife-edges, the transformers and the starting points of the lines can be connected to one or the other series of bars. Registering instruments, placed upon the coupling panel of the bus-bars, are used to show the voltage upon each set of bars at any instant. A Lincoln synchronizer is mounted upon the same panel. In laying out the station provision was made to allow of installing in the future a special type of oil switch so as to be able to connect the two sets of 13,000-volt bus-bars in such a way that one or another of the feeders or groups of transformers can be connected to one or the other set of bus-bars without stop-

ping the service upon this feeder or transformer group.

The accessory services of the plant, such as lighting and working of the unlocking relays of the switches, are carried out at 110 volts by a storage battery. This contains sixty cells of 300 ampere-hours at a three-hour discharge rate, and works in connection with a motor-generator and booster group. This latter group comprises a three-phase induction motor with squirrel-cage armature of twenty-five horse-power, working at 750 revolutions per minute. It is supplied at 220 volts, twenty-five cycles, and is direct-coupled to a fifteen-kilowatt shunt-wound generator. On the end of the generator shaft is mounted a five-kilowatt booster. The booster is designed to give a variable voltage up to forty-five volts, and it is used for the parallel working and the charging of the battery.

For the circuits of the above-mentioned motors for the water pumps as well as for the supply of the booster at 220 volts there are used two static transformers (one serving as a standby) of forty kilowatts each. They are fed from the 13,000-volt circuit at twenty-five cycles upon their primaries. Each of the transformers carries a set of extra terminals at the secondary end, so as to allow of starting up the motors at half the standard voltage. There is provided a switchboard composed of four panels, which is used for the high and low-voltage circuits of these transformers as well as for the 220-volt induction motors, the fifteen-kilowatt generator and the storage battery.

In connection with the present system of hydraulic plants and pole lines there have been erected a number of steam plants, especially in the leading centres. These plants are designed to work either separately or in parallel with the network of lines. About ten plants of this kind have already been installed, representing some 30,000 horse-power in all. One of these is the steam-turbine plant erected not long since at Nice, which we have already described. There is also a second turbine plant at Nice, which is to have a capacity of 4,000-horse-power, according to the present plans. It is known as the Risso plant, and is installed on the premises of the Nice Gas Company. It contains at present two principal steam turbine groups of the Curtis type, with Thomson-Houston alternators. These machines have a capacity of 800 kilowatts. In connection with the plant there is also a section post which is used for coupling these groups in parallel with the pole lines coming from the hydraulic plants of Loup and Mescla in order to supply the 10,000-volt network of the company. A third steam turbine unit of 1,000 kilowatts is shortly to be installed in the plant. The accompanying illustration shows a view of the interior of the Risso plant with the two steam turbine units. In the foreground is observed one of the exciter groups composed of a motor coupled to a 100-horse-power generator.

The switchboard is installed in the second story of a building which is separate from the dynamo building and contains also the offices. All the high-tension apparatus, such as switchboard, transformers, switches, etc., are placed on the ground floor of the same building so as to avoid all danger to the employés.

As regards the main generating groups these are composed each of a turbine-alternator which delivers three-phase current at 10,000 volts and twenty-five cycles. The Curtis turbines with vertical shafts are designed to operate at 1,500 revolutions per minute, and the wheel is coupled to an alternator with fixed external armature and an internal field keyed on the shaft above the turbine. The turbines have been built at the Paris factory of the Compagnie Thomson-Houston, which has erected a large shop for this purpose and is now manufacturing the Curtis wheels very successfully, supplying them to a number of plants on the Continent. Among these is another steam turbine plant which has been lately erected at Nice, of which we have already given a description in a former issue. The regulation of the present wheels has been carried out in such a manner that the consumption of steam per kilowatt-hour is practically constant at all loads. This consumption is found in the tests to be lower than 9.05 kilogrammes per kilowatt-hour for loads varying between 800 and 1,000 kilowatts, and below 10.4 kilogrammes for a load of 400 kilowatts, with the use of saturated steam. It is found also that the use of superheated steam for the wheels allows of reducing the consumption of steam per kilowatt-hour to 7.8 kilogrammes for loads between 800 and 1,000 kilowatts.

The alternators have the revolving field, which is mounted on the shaft, built with the coils placed in large slots and held by steel binding wire. The armature coils, which are placed on the surface of the fixed cylindrical part, have been given a test in the cold at 20,000 volts during five minutes between the armature and the iron, and at 15,000 volts at a higher temperature. The two alternator groups can give an overload current representing 1,000 kilowatts for a two-hour run without any damage and can support a temporary overload of 1,200 kilowatts. The above tests were made with the turbines running with condensation and using a steam pressure of thirteen atmospheres at the inlet of the wheel and a ninety-per-cent vacuum in the condenser. When working on a free exhaust the groups are still able to give 600 kilowatts. As regards the parallel working of the Risso plant with the hydraulic plants of Mescla and Loup, this has been found quite satisfactory.

Four boilers are used for the steam production, which are supplied from a large reservoir. Steam superheaters are installed in the plant, and they are heated by the gases of combustion so as to obtain a superheating of 100 degrees centigrade. The furnaces of the present boilers are provided with special blowers so as to be able to use coal or coke dust when desired. Each of the boilers when using a good quality of coke can furnish 4,000 kilogrammes of steam on the normal run, and as much as 4,800 kilogrammes by increasing the fire. The water which feeds the boilers is supplied by two motor-driven pumps, each of which will deliver 15,000 liters per hour. The piping of the plant, for the four boilers, the two turbines and the other apparatus, has been arranged so as to allow for the future increase of the plant.

There are installed two exciter groups, each of which is made up of a 100-horse-power, three-phase motor working at 750 revolutions per minute, coupled to a direct-current generator on each side. The two generators are designed to furnish fifty kilowatts each, at 125 volts. A bank of three single-phase oil transformers is used to supply the current needed in the plant. Of the fifty-five-kilowatt type they lower the 10,000-volt primary current to 220 and 110 volts. The plant also has two twenty-horse-power, three-phase motors for the water pumps of the condensers, one motor of the same size for the air-pump, and a smaller motor for supplying the reservoir from a well. There are two small direct-current motors which are used for the boiler supply. A sixty-cell storage battery works in connection with the exciter and the lighting circuits of the plant.

The main switchboard consists of three series of panels, which are used respectively for the alternators of the plant, the coupling of the pole lines coming from the Mescla, Loup and Menton plants, and the underground feeders leaving the station. On the panels which are used for the feeders supplying the light and power circuits of Nice it was found necessary to use circuit-breakers with a time-relay break action, owing to the sudden shocks which may come upon the feeders used mainly for the tramways. Such impulses would cause the ordinary circuit-breaker to work constantly, and this would not be practicable in the present case.

American Electrochemical Society.

Thirteenth General Meeting, Held at Albany, N. Y., April 30, May 1 and 2.

THE thirteenth general meeting of the American Electrochemical Society was called to order by President C. F. Burgess in the auditorium of the Ten Eyck Hotel, Albany, at 10.30 Thursday morning, April 30. The headquarters of the society had been established at this hotel and there was a good attendance at the first session.

The meeting at once proceeded with the reading and discussion of papers, the first to be presented being by H. L. Bronson on "The Construction and Accurate Measurement of Resistance of the Order of 10,000 Megohms." This paper calls attention to the difficulty of measuring the exceedingly small currents which flow as the result of the ionization of the gas, currents of the magnitude of 10^{-15} amperes and up. Such currents may be measured in a sensitive galvanometer if they be constant, but ionization currents produced by the emanations such as that of thorium, which decay rapidly, are too variable to be measured in this way. Thorium emanation decays to half value in less than one minute, and the current due to the emanation which has been cut off from the supply falls to $\frac{1}{2000}$ of its value in ten minutes. The problem is, therefore, to get an instantaneous measurement of exceedingly small currents and yet the apparatus must be capable of a considerable range of measurement without serious readjustment.

The older methods employed in measuring such small currents depend either upon the use of the electroscope, which is probably the most sensitive instrument, and may be used for measuring a change of potential of five volts an hour, or the electrometer, which is not so sensitive, may be used over a much wider range. Both of these instruments present many difficulties if an attempt is made to use them for measuring accurately the small varying currents due to radioactivity; the sensitiveness of the instrument changes and the reading lags behind the change in potential unless the change be exceedingly slow. In using them it is necessary to measure accurately small capacities which must be redetermined for every new testing vessel in which the emanation is enclosed. For rapidly changing currents, the usual method is practically impossible. Another method employing the constant deflection principle was suggested to the author by Professor E. Rutherford. This makes use of an electrometer, one pair of the quadrants of which is connected to the earth, and the other pair to the testing vessel containing the emanation. This pair is also connected to the earth through a very high resistance. In this way any current in the testing vessel will tend to charge the electrometer unless the discharge current through the high resistance just balances or exceeds it. The current flowing is proportional to the potential upon the electrometer, and if the sensitiveness of the instrument be known, and, also, the value of the high resistance, the ionization current is also known. A potentiometer may be used in this arrangement in order to give an increased range to the apparatus. A charging battery is, of course, connected in circuit with the testing vessel. The advantages of this method are: the deflections are independent of the capacity of the electrometer, instantaneous readings may be obtained, and one reading may follow another as quickly as desirable. There are also several practical advantages, one of which is the small error due to leakage across the insulation of the instrument, since the readings are taken quickly. The application of this method depends, therefore, upon finding some means of making and preserving resistances of the order of 10^{11} ohms. A number of the older forms of high resistance are unsatisfactory for this purpose. Those depending upon graphite are uncertain, since the resistance here seems to be that due to poor contact and for variability. After examining various arrangements it was suggested by Rutherford that an ionized gas might be employed for this purpose, and after some experiment a resistance of this kind was found which gives satisfactory results. It consists of a cylinder of ebonite, one end of which is closed with an aluminum plate and the other end by an ebonite plug, also covered with aluminum. The plate contains a minute quantity of radioactive material, in this case about ten milligrammes of radium bromide. While with such an arrangement the ionization current is not generally proportional to the potential difference between the plates, it has been found possible to arrange the distance between these two plates so as to approximate a linear relation. However, it is always necessary to obtain a calibration curve for the resistance, a rather difficult task since the resistance of the gas is from ten to 100 times as great as the value usually given for the insulation resistance of condensers. The best method of doing this is by means of a standard condenser used so that the average potential during the test is zero. It was found advisable, however, to check the calibration obtained in the way just mentioned by a second method. These resistances were found to be so satisfactory for the purpose that the author suggests that permanent high-resistance standards might be made in the same way. These would be found useful for measuring high resistances and for testing insulation.

In the discussion Dr. F. A. Wolff said that Professor J. W. Richards had suggested a somewhat similar method of measuring high temperatures.

C. Hering said that reproducibility of such a device was not important. He had found high resistances made of graphite unreliable; electrolytes were not good, but he suggested that the drift of small, solid particles, held in suspension in liquids, might be employed for measuring such currents, as he had found that these bodies will move under the influence of small potentials.

W. D. Bancroft asked whether the oxygen contained in the vessel did not eventually act upon the ebonite. Mr. Bronson, in reply, said this had been thought of, but no effect had been detected.

R. W. Boyle presented a paper entitled "The Absorption of Radioactive Emanations by Cocoanut Charcoal." This reviewed briefly Dewar's work and described an examination of three kinds of charcoal: wood, animal and cocoanut. Different sizes of particles were studied, and, also, the effect of temperature. The cocoanut charcoal shows the greatest absorption, and the large particles absorb the more rapidly. At the temperature of solid carbon-dioxide the absorption is very great, but decreases with a rise in temperature, but there is some absorption even at 300 degrees centigrade. It was found that the upper layer of the charcoal is the most active, a thick layer of fine charcoal being practically no more absorptive than a thinner layer. The experiments showed plainly that the emanations behave just as an ordinary gas would, except that they decay. The work was mainly done with thorium emanation.

Dr. F. A. Wolff presented a paper on "New Observations of the Temperature Coefficient of Weston Standard Cells." This gave the results of studies of 200 cells made by different physicists, the temperatures varying from zero to forty degrees centigrade, measurements being made every five degrees, with both rising and falling temperatures, so as to complete the cycle. Each cell was maintained at the temperature at which the measurement was to be made for about forty-eight hours before this was done. It was found that the usually accepted equation, giving the electromotive force in terms of the temperatures, was not satisfactory, and that it was necessary to add a third term. The corrected equation is as follows: $E_t = E_{20} - 40\ (t - 20) - 0.94\ (t - 20)^2 + 0.009\ (t - 20)^3$. With this equation all cells give a value of the third term agreeing within ten per cent. The electromotive

force of the cells is a maximum between zero and five degrees centigrade. This is also the temperature at which cadmium sulphate has a maximum solubility, while the zero-temperature-coefficient cells are made from a solution saturated at four degrees centigrade. It was found that the cells exhibited a slight hysteresis effect, the values for potential being higher with a rising temperature than when it is falling. The former values are also closer to the normal than the latter.

Dr. H. S. Carhart said that no doubt the hysteresis effect was due to a failure to crystallize. This depends upon the size of the crystals and the ability of the dissolved salts to diffuse throughout the cell. It is a question what is the best size of crystals to be used when making cells. Dr. Carhart has found that cells made with chemically precipitated mercurous sulphate give more constant results than those using the electrolytic salt. Referring to a question about the lag of the thermometer, Dr. Wolff said that the cells were placed under oil during the tests and no difference in temperature from that indicated could be detected. This hysteresis effect is of minor importance in cells which can be maintained at a constant temperature, but as the effect was found to be most noticeable in abnormal cells, it may be useful in detecting these cells. The trouble, he thinks, lies in the mercurous sulphate, and, contrary to Dr. Carhart, the electrolytic salts have given him the most satisfactory results.

A paper by J. W. Wilkinson, entitled "Mercury Cathodes in Nitric Acid Solution," was presented in abstract by Dr. Bancroft. This described the work done to check some early experiments which had seemingly shown that the action taking place between copper and nitric acid, when a current was passed through the solution, was different from that when purely chemical action took place. An examination of the conditions showed that they had not been the same in the two cases, and that when similar conditions were secured, identical results were obtained, thus indicating that there is no difference between chemical and electrolytic action.

J. F. McElroy gave a brief review of the early work of Joseph Henry while he was instructor in the Boys' Academy, at Albany. During this time he constructed the first powerful electromagnet and also transmitted signals, by means of an electric current, through a wire over 1,000 feet long. This is believed to be the first electric telegraph. During this work Henry realized the necessity of winding a large number of turns upon his electromagnets and of placing his cells in series in order to produce the best results. While working with one of his magnets during this time he noticed when he pulled the armature away from the magnet that he got a kick on the galvanometer. This was before Faraday noticed the electromagnetic induction of current.

Dr. Carhart pointed out the striking fact that this work of Henry's was done not very long ago. He liked to think of Henry's experiment as the first electric transmission of power on record. He then sketched briefly the action of the International Electrical Congress when "Henry" was adopted as the name of the standard of inductance. An interesting feature of this was that the proposal was made by Mascart, a Frenchman; it was seconded by an Englishman, and the definition finally accepted was given by Ferraris, an Italian.

The morning session was then adjourned.

THURSDAY AFTERNOON.

The annual business meeting of the society was called to order Thursday afternoon, at 2:10, by President Burgess. The report of the board of directors was presented by Secretary Richards. This showed that the present membership is 715; the society has a very substantial balance to its credit, and back volumes to the value of about $10,000. It has been decided to hold the fall meeting during the month of October next, in New York city.

The president then stated that Director S. W. Stratton, from the Bureau of Standards, Washington, had requested the society to appoint a committee to confer with similar committees from the American Institute of Electrical Engineers and the American Physical Society, regarding recommendations to be made to the coming International Electrical Congress. The most important matter to be taken up is the adoption of fundamental standards and assigning them numerical values. He called upon Dr. F. A. Wolff to explain the matter more fully. Dr. Wolff reviewed briefly what had been done and pointed out the advisability of adopting only two of the three units—the volt, the ampere and the ohm—as fundamental, the third to be derived from these by Ohm's law. He said practically every one is agreed that the ohm shall be one of the two fundamental units, but the question now is whether to adopt the volt or the ampere as the other. The English and German physicists are in favor of the ampere; on the other hand, the Bureau of Standards think it would be more advisable to adopt the volt and derive the ampere. Dr. Wolff then discussed these two units, comparing their relative reproducibility, concreteness and accuracy of reproduction, and concluded that the advantages lie with the standard cell as against the coulombmeter.

President Burgess said that the board of directors had nominated the following committee for the purpose suggested: Carl Hering, J. W. Richards, Edward Weston and H. T. Barnes. This action was confirmed by the society.

A letter was then read by the secretary from the Pacific Coast Borax Company, offering a prize of $500 for the most satisfactory method of preparing ferro-boron from borate of lime. The company will furnish the borate of lime free. The offer was accepted by the society and the board of directors was requested to draw up the terms of the competition.

The secretary announced the result of the recent election, which was as follows:

President—E. G. Acheson.

Vice-presidents—C. P. Townsend, C. A. Doremus, W. R. Whitney.

Managers—F. A. J. FitzGerald, A. V. Isakovics, S. A. Tucker.

Treasurer—P. G. Salom.

Secretary—J. W. Richards.

Dr. A. T. Lincoln suggested that a second grade of membership should be formed so that students might obtain the benefits of the society without the expense of full membership. This matter was referred to the board of directors.

President Burgess then delivered the annual presidential address, the subject being, "The Corrosion of Iron from the Electrochemical Standpoint." He pointed out the great practical importance of the depreciation of engineering structures. The rate of decay of iron is hardly realized by the public; in fact, this is a very variable quantity. It may be as little as one per cent, or as high as twenty per cent. When the values at all approach the latter figure, the importance of the subject is evident. Corrosion may be taken as a generic term, covering many diseases, and there is an insistent demand for a further study of this decay. Recently it has been contended that the rusting away of iron, when exposed to the action of the earthen air, is electrochemical. The corrosion of underground structures had formerly taken place but slowly, but more recent experience has shown that disastrous effects may result. It is thought to be the province of the electrochemist to determine what is the cause. An electrical current passing out of an iron structure into a solution will eat it away. Under certain conditions, a current entering iron also corrodes it; so that a mere reversal of the current flowing through the structure will not prevent its corrosion from currents furnished from outside sources. It is also a question how far the use of alternating currents, instead of direct currents, will prevent this trouble.

Another kind of corrosion may take place—that which is really galvanic action caused by impurities in the iron which act with the neighboring iron to produce local currents. Carbon particles in iron would probably cause electrolytic action, irrespective of the size of these particles. Micro-photographs of iron and steel were shown, indicating the non-uniformity of these materials and suggesting the possibility of local action. The work of Dr. Walker seemed to show that such action did really take place.

Professor Burgess then gave some most interesting results of experiments which he had conducted to see if the influence of strain on iron would affect its corrodibility. This had been suggested by the old problem of what became of the kinetic energy of the spring which was wound up and then dissolved in acid. It seemed likely that the energy thus stored up should have some effect upon the rate of reaction. Some experiments by C. Hambuechen, in which attempts had been made to measure the change of electromotive

force with the change in stress upon the material, were described. These seemed to indicate that the electromotive force did increase with the stress. Such an effect should increase the electrochemical activity of the strained iron. Walker had found that this effect is very low if the stress upon the iron is less than the elastic limit. It is difficult to measure these effects, as when the electromotive force is measured, it is always that of the more electropositive material. Hambuechen's results seemed to indicate potential differences higher than values which had been calculated. A number of photographs were shown of test rods and samples which had been stressed, turned to a uniform diameter and then etched. Rods exposed to a simple tensile strain corroded rapidly along the strained surface in lines parallel to the axis of the test piece. When submitted to a tortional stress and treated in the same way, the strained surface again corroded, and the lines of the etching followed the twist given to the metal. In all these cases the metal had been stressed above the elastic limit. Punched boiler plates showed a somewhat similar effect, the metal corroding more rapidly around the opening and in geometrical curved lines from this point. The punchings also showed rapid corrosion along the edges where the metal had been strained most severely. Tempered steel corroded along lines which seemed to indicate that the surface of the metal was under strain. When such a sample was annealed, repolished, and then corroded, the regular markings again appeared. One tempered sample, after being slightly corroded, cracked; apparently because the surface had been removed.

Professor Burgess discussed the action of difference of temperature in setting up electromotive forces in structures, such as locomotive boilers, and showed how a difference of potential between the lower layer of boiler tubes and the bottom of the shell might be expected, thus agreeing with experience, which has shown that it is this layer of tubes that suffers most severely. He also showed that there should be a tendency for an electromotive force to be set up in the end plates around the tubes, an action which, as is well known, does take place. The effect of steam pressure was investigated, and it was found that the electromotive force increased with the pressure, but these electromotive forces, with repeated experiments on the sample, decreased. It is thought that this probably was due to the removal of oxygen from the water. When the latter was saturated with carbon dioxide, it was found that the electromotive force set up was much less. He concluded, therefore, that the presence of carbon-dioxide in feed-water is not a disadvantage. In fact, if sodium carbonate, a common constituent of boiler compounds, be introduced into the feed-water in proper proportion, the electromotive force may be reduced to zero, or even reversed.

The discussion was opened by E. G. Acheson, who said that iron submerged in water containing deflocculated graphite does not rust, but if removed to other water, rusting takes place. More recent work seemed to indicate that when this graphite is rubbed into a ground shaft, it acquires some ability to resist corrosion.

Mr. McElroy described some experiments in which plates of iron had been drilled with a various number of holes. He found that the conductibility of the iron, allowing for the metal removed, had been affected.

Dr. Wolff pointed out that the shape of the path, as well as the average cross-section, would affect the resistance of the sample.

Dr. Bancroft said that measurements of electromotive force do not determine what the total action will be, as the electromotive force is merely characteristic of the surface film.

Dr. Carhart reviewed briefly some interesting cases of electrolytic corrosion. Usually it is found that a comparatively small hole is pierced through the iron, seeming to indicate that the action is voltaic. Moreover, vertical poles frequently suffer greatly, which would hardly be the case if the corrosion was due to stray currents. He also suggested that the thermoelectric effect, as indicated in the Helmholtz equation, should not be overlooked. In the usual electrolytic surveys of underground conducting systems, a great many factors such as this are overlooked, so that the actual results are valueless. A communication from Dr. J. W. Richards was read, in which it was pointed out that electrodes which are not in equilibrium will not give constant results.

E. Blough presented a paper on "Industrial Applications of Aluminum." This described the various forms in which metallic aluminum, or alloys of aluminum (the latter used for making castings), are now obtainable.

R. H. Gaines presented a paper discussing the "Electrochemical Corrosion of the Rochester Steel Conduit." The first portion of this was laid in 1893, and was coated with asphalt. In six or seven years leaks were found in the pipe, which increased in number yearly. When this occurred, the pipe was repaired and covered with an anti-corrosive paint. Last year part of this pipe was uncovered and he was allowed to inspect it. He found four-fifths of the plates in good condition, and the remaining one-fifth pitted and corroded. (It has been said that the inside of the pipe was but slightly corroded.) All the leaks seemed to be from corrosion on the outside. No foreign currents were detected in this pipe. He concluded that the effect is due to local conditions and to defective coatings, and that the conditions favor this decay and outside currents would merely tend to aggravate it.

Mr. Hering said that although no currents had been observed flowing in the pipes, this did not exclude electrolytic effects, as a very small current concentrated at one point would, in a short time, produce disastrous results.

This led to a brief discussion on proper ways of measuring currents in pipes, in which Messrs. McElroy, C. H. Sharp, Hering, H. N. Potter and H. S. Carhart took part.

A paper on "Copper Anodes in Chloride Solutions," by Paul Dushman, was presented in abstract. This showed that copper may go into solution both as a cuprous and cupric salt, depending upon the conditions.

The session was then adjourned.

THURSDAY EVENING.

Thursday evening the society met at the Ten Eyck Hotel to hear a lecture by Dr. W. D. Bancroft on "The Electrochemistry of Light." Rumford and Bunsen held that light acts exactly as heat, and to a large extent this seems to be true. Nevertheless, light may produce chemical reactions not directly producible by heating. This was shown experimentally by preparing a solution which was first heated without any effect being produced, but when exposed to the light from a burning magnesium ribbon, a white precipitate was formed. Moreover, if light and heat behaved in the same way, one would expect the red rays, which represent the more energy, to be more active chemically than those from the other end of the spectrum, while, as a matter of fact, the violet rays are more actinic. The question then is raised, what generalization is possible? Up to this time none that has been made holds universally. Grothus formulated the first two laws of photo-chemistry. The first of these is that only the light which is absorbed can bring about chemical action. The second is: "A ray of light is analogous to a linear voltaic cell." The meaning of the second law is not clear, but evidently he had some idea of the similarity between electrochemical and photochemical action.

There are two effects which may generally be observed, due to light. One is that caused by the heat of the radiation, and the other that due to the chemical energy, which, through the action of the light, produces decomposition. Hence, anything facilitating decomposition, such, for example, as a depolarizer in an electrolytic cell, would simulate the effect of light.

An early experiment of Grothus was described, in which it was shown that a certain solution exposed to the rays of the sun in the open air turned red in the afternoon; during the night it became clear again; in the morning it was again reddened; but at mid-day, when the sunlight fell directly into the vessel without passing through the glass walls, it was again clear. The explanation of this is that the solution was reduced by the sunlight after the latter fell upon it, except when the sunlight entered through the layer exposed to the air. When this occurred the oxygen of the air at that point acted as a depolarizer, and the solution was oxidized and rendered colorless. This was proved by sending a ray of sunlight up through the bottom of the vessel, allowing it to pass out of the solution up through the surface in contact with the air.

Dr. Bancroft then described a goodly number of experiments which had been arranged to show that the action produced

by light could be produced electrolytically, and by properly arranging the conditions this result invariably followed. This seemed to indicate the similarity of photochemical and electrochemical action. The lecturer also showed a number of photographic papers which had been acted upon by passing current through them from a metallic plate. When developing the papers, an image was produced which was exactly similar to a photograph, though, of course, without any relief.

As the lecture was open to discussion, Dr. Leo Baekeland said that without doubt the most important chemical effect of which we are aware is due to the action of light. This is the action by which the chlorophyl of plants absorbs carbon-dioxide from the air. Up to the present time we have no method of finding out what is the effect of the light. Chemical analysis fails utterly to indicate any change whatever in the sensitive materials after exposure, and the only means by which this effect can be produced is by treating them with some reducing agent. Here is an exceedingly important field for investigation, but one presenting very great difficulties. The magnitude of the difficulties may be appreciated if one tries to imagine how chemical research could be carried on if we were without sight. He also referred to a very important case in which a large amount of photographic paper had been spoiled through minute particles of metal which had been taken up by the paper from the calendering rolls. Each little speck produced a black ring surrounding it, rendering the paper useless.

The lecture was followed by the reading of a paper by E. R. Taylor on "Water Power in the Adirondacks and Forest Preservation." Mr. Taylor called attention to the enormous importance of preserving the forests, but said that mere preservation of the forests will not begin to solve the problem of preserving the water powers and avoiding floods. Photographs were shown representing bad floods which occurred as early as 1857. The correct solution involves not only care of the forests, but the construction of ample storage lakes. In this way floods will be avoided, power will be made available throughout the entire year, and control of the flow of water will improve the navigation of the rivers. He said that the water powers of New York state, if properly protected and developed, represent a greater value than the coal fields of Pennsylvania. It has been estimated by the State Water Storage Commission that the water power of the state is sufficient to produce an annual profit of $18,000,000, equivalent to the net profits from agriculture in the state.

The evening session was then adjourned.

FRIDAY MORNING.

Friday morning the session was called to order at ten o'clock in the chemical lecture room of Union University, to which point the members had been carried by special cars. The session was opened by a lecture delivered by Dr. C. P. Steinmetz on "Kinetic Molecular Energy." The lecturer said that the fundamental laws of thermodynamics, which are of vital importance, are expressed in forms which are difficult to understand, so that it would be a good plan if they could be stated in a way which would give a conception of the principles of thermodynamics. Heat energy may be assumed to be irregular molecular, or atomic motion. Assuming the molecules to be constituted of matter, each must have a certain motion which is the result of the action of all surrounding molecules. They may be accelerated or retarded, and may oscillate, or revolve about one another in certain orbits. Considering first a solid body, the heat energy is low and hence the motion of the particles is slight. As the temperature is increased, the paths become longer, but the average path of the molecules is constant; the solid, therefore, has size and shape. A rise in the temperature increases the path of the molecules until the tendency for them to move is greater than the forces tending to hold them in a fixed position. The liquid condition is that in which the velocity just carries the molecules against the opposing forces. They are still moving in an enclosed orbit, so that a liquid has size. If the temperature be raised still higher, the speed of the molecules increases still more, and the point is finally reached when this is sufficient to carry them out of the influence of the neighboring molecules. The substance then loses its liquid form and becomes a gas, and the molecules travel in open orbits. All of these conditions are found in the study of the solar system. The planets are traveling around the sun in fixed orbits, while many of the comets move in open orbits. Here we have the effect of the motion of the various bodies counteracted by the forces of gravity acting between it. It was pointed out that these bodies are caused to travel in their various orbits without ever coming into actual contact. Hence it is not necessary to believe that there is an actual clashing of atoms or molecules in any substance. As one approaches the other they swing around one another and start off in their respective directions. Energy may be transferred thus from one to the other without any contact.

Following this line of reasoning it would seem that it must occasionally happen that a particle will some time or other approach the bounding surface of the solid or liquid at a velocity which will carry it beyond the influence of the rest of the body. Hence it follows that all solid and liquid bodies must evaporate.

Dr. Steinmetz, also, showed how double molecules, such as are apparently found in gases, may be formed by two or more molecules coming close enough together to revolve one about the other. Considering more specifically the laws of gases, from the line of reasoning just followed, it is evident that the pressure exerted by a gas is proportional to the number of molecules, to the mass of each molecule and to the square of the velocity, or, in other words, upon the momentum of the particles and their number. Moreover, since the temperature is a function of the energy of the particles, this will also be proportional to their mass and square of the velocity. It follows from this that pressure and temperature are directly proportional, and that the volume is inversely proportional to the pressure, and the product of pressure and volume will be equal to a constant multiplied by the absolute temperature. These are recognized as the laws of gases which are here deduced with no other assumption than that the molecules have an irregular motion due to internal forces. By the same line of reasoning Avogadro's law may be deduced. When a particle strikes a moving boundary it loses in velocity by twice the velocity of the boundary. Applying this principle to the expansion of the gases, it follows that when they are allowed to expand, in other words, when the boundaries move, the temperature must fall.

Dr. Steinmetz showed also how a complex molecule could be split up by the action of another molecule. This would exert its attraction more strongly on the nearest one of the combination, tending to increase its velocity the more, and if the effect was sufficiently great it would separate the two, just as the sun is known to disperse meteor swarms as they pass around it. He showed how the constants for monatomic, diatomic and triatomic atoms would be calculated from the reasoning just laid down, and the values thus deduced agree well with those determined experimentally. He concluded that all the laws of gases may be therefore deduced directly by applying the laws of motion and the law of probabilities.

The lecture was followed by a paper by Professor J. W. Richards on "The Heat of Vaporization of Metals and Other Substances." From a study of a large amount of data it has been found that the latent heat of vaporization is about twenty-three times the absolute boiling temperature. Hence, if this temperature be known, the latent heat of vaporization may be calculated. However, the metallurgist wishes to know, also, the total heat of vaporization, and he had found that this is very closely thirty-three times the absolute temperature. This law, as far as he has applied it, checks up satisfactorily.

A paper by A. B. Marvin, Jr., on "Electrochemical Patents," was then read by the author. This discussed the origin of the patent law of this country, described its gradual development, and showed how the Patent Office, due to an insufficient staff, is constantly falling behind. This condition, also, results in a hasty search, so that not infrequently patents are allowed which are not really good.

L. C. Raegener, in discussing this paper, said that during thirty years of practice, in which he had won many suits for his clients, he had not yet found a single instance in which the judgment awarded recompensed the inventor. He believes that the laws need revising more than the Patent Office. Under the present conditions the country is to all intents and purposes divided into nine countries so far as the patent law is concerned, as there

are nine circuit courts, no one of which is at all affected or influenced by a decision made in another. A suit won before the Circuit Court of New York has no effect whatever before the court in Chicago.

Dr. H. N. Potter pointed out the difference in patent practice in Germany. There the first man to apply for a patent usually gets it, and the protection which is given is better. Replying to this, Dr. Steinmetz said that in this country it had been thought better to protect the inventor rather than the patentee.

Mr. Marvin, closing the discussion, called attention to the bill now pending before Congress, and said that the German office has a staff three times as large as that in this country and grants fewer patents. Naturally, patents obtained in this way should be strong.

E. E. F. Creighton read a paper entitled "The Electrical Testing of Iron During Annealing." This described a methed of studying the effect of annealing in which the sample to be studied was made the secondary of a transformer, the currents thus produced in it causing the heating. The apparatus seemed to give good results and in this way he had studied the effect of different gases present during the annealing process. This seemed to be important. Ammonia was bad, although nitrogen seemed to be inert and hydrogen beneficial.

Dr. Steinmetz pointed out that electrolytically refined iron does not seem always to be pure, as it is not always soft. It is deposited from an ammonia solution.

Professor Burgess said that chemical analysis of iron refined in this way showed the presence of nitrogen.

A paper by J. Meyer on "Power for Electrochemical Industries" was read in abstract. This called attention to the importance of cheap power for the electrochemical industries and the desirability of bringing these into closer relations with the power companies. However, what is most needed is some use for power which will fill out the load-curve, and a constant demand for twenty-four hours will not accomplish this. Special inducements will be offered only if the demand acts as a load balancer.

The following two papers were then read by title: "Robert Hare's Electric Furnace," by Dr. C. A. Doremus, and "The Direct Synthesis of Hydrocyanic Acid," by E. W. Smith and R. S. Hutton. The former describes the furnace made by Robert Hare, the inventor of the oxy-hydrogen blowpipe, in the early part of the last century; the latter describes a method by which hydrocyanic acid is formed when carbon is heated by an electric current and hydrogen and nitrogen are passed over it.

The session was then adjourned.

SATURDAY MORNING.

Saturday morning the meeting was called to order at 9.30 in the chemical lecture room of the Rensselaer Polytechnic Institute, at Troy. The first paper to be presented was "The Alloying of Iron and Calcium," which was submitted by A. Hirsch and J. Ashton. This was abstracted by President Burgess. When studying the rarer earths, iron and calcium have been found together. It has been stated that iron and calcium do not alloy, and direct attempts to produce such an alloy have not been successful. From the fact just mentioned it seemed the rarer earths might in some way bring about such an alloy. Attempts to do this have been entirely successful, as alloys of various proportions of iron and calcium were secured. The physical properties of these were described. The research was simply of scientific interest as the alloys corrode, are usually brittle, of poor mechanical properties, and have no practical value.

A paper on "The Preparation of Calcium Alloys or Aluminothermic Work," by O. P. Watts and J. M. Breckenridge, was read by the former. Due to the severe conditions necessary to prepare these alloys, they are difficult to obtain. Refractory materials for the crucible are hard to get. However, alloys with boron, titanium, tantalum, magnesium and silicon have been secured. The difficulty is to prevent the volatilization of the calcium at the temperatures necessary to melt the other metals. Alloys of calcium with aluminum, magnesium and silicon have been obtained containing as much as seventy per cent of calcium. These are alloys either of calcium and one other metal, or calcium with two, and even three, of the other metals mentioned. All of these alloys decompose water; they are brittle, so that they are easily ground up; they give violent reactions when used as reducing agents, except the one containing aluminum. This is probably due to the low boiling points of the metals. These alloys cost from sixty cents to $1.50 a pound for the materials only.

Professor Richards suggested that instead of the term "aluminothermic," "metallothermic" should be used to cover the general process, as aluminum may not take part in the reaction.

Carl Hering, in a paper entitled "Direct Currents in Electrolytes Without Electrodes," described a number of methods by which direct currents might be set up by means of unipolar induction. No experiments have been made. The question was raised whether any electrochemical action would take place or there would be any change in concentration of the solutions or whether the solution would conduct as a metal.

A paper by J. W. Turrentine, entitled "Reversed Electrolysis," was presented in abstract by Dr. Bancroft. This discussed certain electrochemical reactions in which abnormal results seemed to take place. Gold, for example, may be deposited on the anode. These reactions were all explained by secondary chemical reactions going on in the cell.

Dr. J. W. Brown read a paper on "The Use of Dry Batteries for Ignition Service." In this use these batteries now compete with storage batteries and magnetos. The most trouble the manufacturers experience is due to improper use. When ordinary ignition coils are employed five or ten times as many sparks may be produced as are necessary. This is a needless waste of energy, for if the first spark is intense enough to explode the mixture, the others are useless, and if it will not, the others will not either. On the other hand, there are some ignition devices on the market which produce a single spark at the proper moment with, of course, much less drain upon the batteries. He urged the use of large batteries or a good number in parallel, as the life and efficiency of the battery is greatly increased by a reduced rate of use.

President Burgess said that few people to-day realize the importance of the dry-battery business. A rough computation led him to estimate the total output of dry cells in this country at 30,000,000 a year. At the present time the manufacturers seem to aim at a high current output at a sacrifice of good qualities.

Replying, Dr. Brown said that the excuse for this is that while the average use of the batteries is slight, the momentary current is fairly large—of the order of five amperes—and the cells must be able to deliver this current.

W. S. Rowland presented a paper on "Electrolytic Corrosion of Aluminum Bronze." The corrosive effects of electric current on various bronzes in various solutions was tested, and the results of this research were given.

Dr. A. T. Lincoln, in a paper on "Further Researches on the Electrolytic Corrosion of the Bronzes," explained the results of experiments with these alloys in artificial sea water. They corroded readily, and it was found that a solution of pure sodium chloride produced as much effect as the sea water.

A paper by E. F. Kern, on "The Electrolytic Refining of Iron," was read in abstract by Dr. Bancroft. This reviewed the work which had been done, and said his own investigations led him to believe that the chloride solutions are the best for this purpose.

Dr. Richards, discussing the paper, pointed out the opportunity which he believes now exists for a commercial iron-refining plant. High prices are now paid for special brands of steel, and the manufacturers of these would welcome a supply of pure iron, the price of the latter being of little moment.

Professor Burgess pointed out that the cost of the process is low; that there are satisfactory processes now available which are not hampered by patents; but before going into it prolonged tests should be made. After a short time, the solution goes bad, and is apt to give trouble.

H. T. Barnes and G. W. Shearer presented a paper entitled "The Nature of the Surface Film formed on Aluminum and Magnesium, and the Aluminum-Magnesium Cell." Their investigations agree with the results previously published, as there seemed to be an oxide coating formed on the surface of the anode.

Dr. W. R. Whitney, referring to this paper, asked if any one could give some information respecting the practical value of such rectifiers. His experience with

them had not been altogether satisfactory. Theoretically, they are beautiful devices, but, practically, they give trouble.

Professor Burgess said that in such cells the anode corrodes, and the electrolyte changes, so that after a while the rectifier fails.

The following papers were read by title: "Conduction in Electrolytes," by L. Kahlenberg; "The Conversion of Iron Pyrites, FeS^2, into a Magnetic Form," by O. L. Kowalke.

This closed the technical meeting of the society, and a resolution was then adopted unanimously thanking the General Electric Company, Union University, Rensselaer Polytechnic Institute, Hudson River Water Power Company, the West Virginia Paper Company, the Hargreaves-Bird Company, Watervliet Arsenal, the local committee and others who had offered courtesies to the visiting members.

President-elect E. G. Acheson was then introduced, and in a few words he begged the support of the members of the society during the coming year.

The meeting was then adjourned.

The social features of the meeting consisted of a lunch tendered to the society by the General Electric Company in its restaurant, Friday afternoon, followed by an inspection of its magnificent establishment, at Schenectady; an informal dinner at the Hotel Ten Eyck, Friday evening, and a lunch at the Rensselaer Inn, Troy, Saturday afternoon. After the lunch many points of interest in and near Troy, such as the Mechanicsville plant of the Hudson River Power Company, the Duncan Paper Mill of the West Virginia Paper Company and the Watervliet Arsenal, were visited.

Convention of the Missouri Electric Light, Gas and Street Railway Association.

The annual convention of the Missouri Electric Light, Gas and Street Railway Association was held on April 23, 24 and 25 at the Marquette Hotel, St. Louis, Mo. W. A. Layman delivered the address of welcome, the response being made by Dr. J. D. Porterfield, president of the association.

The following papers were read: "Economical and Secondary Distribution," by Hugo Wurdack, of St. Louis; "Recording Wattmeters," by R. C. Lanphier, Springfield, Ill.; "High-Efficiency Lamps," E. H. Haughton, Chicago, Ill.; "Incandescent Lamp Development," G. S. Osborn, Harrison, N. J.; "Central Station System and Records," Horace W. Beck, St. Louis; "Popularizing the Use of Electricity," E. L. Callahan, Chicago; "Alternating-Current Motors," W. Robbins, St. Louis.

The following officers were elected for the ensuing year:

President—W. B. Hays, manager Poplar Bluff Lighting Company, Poplar Bluff.

Secretary—Claude L. Clary, manager Sikeston Electric Light and Power Company, Sikeston.

New York Electrical Society.

The 276th meeting of the New York Electrical Society was held in the Engineering Societies Building, Wednesday evening, April 29. W. N. Dickenson, Jr., manager foreign department Otis Elevator Company, lectured on "Modern Progress in Elevator Practice."

The lecture was arranged with a view to illustrating the pronounced tendency toward the operation of elevators from electric circuits, the degree of perfection which has been attained in direct-current elevators, and the outlook for the duplication on alternating-current circuits of all classes of service now possible on direct-current circuits.

With an introduction read from manuscript, something over 120 photos were shown on the screen. It was evident that the lecture had been logically arranged to bring out the points as outlined, but the abundance of matter discussed in the early part of the discourse prevented the intended full treatment of the alternating-current section, in which branch of the subject the main part of the audience was manifestly interested.

The society is endeavoring to have the matter prepared in such form that it may be published. It is to be hoped that this will be done.

After establishing the fact that any elevator service yet demanded is now possible with direct-current machines, it was shown that similar service, except that required for the high office buildings in the direct-current section of the large cities could be accomplished with multi-phase alternating-current machines, simple and neat in appearance and presumably satisfactory in operation. With a load of 2,500 pounds 250 feet per minute was the highest-speed installation mentioned, but it was indicated that higher speeds could even now be taken care of by complicating the control, and there is, of course, no limit with respect to load at low speeds.

In single-phase operation it would seem that machines now installed have been confined to the smaller sizes, but the photos of single-phase controllers showed quite as simple apparatus as for multi-phase control.

For Governmental Control of Wireless Telegraphy.

President Roosevelt sent to the Senate on April 25 the reports of the War and Navy departments and the Department of Commerce and Labor on the international wireless telegraph convention, signed at Berlin, November 3, 1906. All three departments recognize the necessity for some rules governing the exchange of aerial messages. The need is urgent for the reason that there are now in the United States ninety-seven wireless shore stations. Of these, forty are operated by the Navy, sixteen by the Army, and forty-one by private parties. A deal is now under consideration by Congress providing for rigid governmental control of wireless communication, and fixing penalties for private persons who interfere with government messages or indulge in false messages.

Technical Publicity Association.

The Technical Publicity Association at its annual meeting, April 30, 1908, elected the following officers to serve during the ensuing year:

President—C. S. Redfield, advertising manager Yale & Towne Manufacturing Company, New York.

First vice-president—Rodman Gilder, publicity manager Crocker-Wheeler Company, Ampere, N. J.

Second vice-president—C. N. Manfred, manager advertising department H. W. Johns-Manville Company, New York.

Secretary—H. H. Kress, publicity department A. S. Cameron Steam Pump Works, New York.

Treasurer—H. M. Davis, advertising manager Sprague Electric Company, New York.

Members of executive committee—F. H. Gale, charge of advertising, General Electric Company, Schenectady, N. Y., and C. W. Beaver, special representative Yale & Towne Manufacturing Company, New York.

Twenty new members have joined the association since the last annual meeting.

Opening of Brooklyn Subway Extension.

The Interborough Rapid Transit Company opened the extension of the Brooklyn spur of the subway from Borough Hall to Flatbush and Atlantic avenues on Friday, May 1. A celebration was held at the Baptist Temple, Brooklyn, N. Y., William R. Willcox, chairman of the Public Service Commission for the First District, presiding. Among the speakers were ex-Mayor Seth Low, August Belmont, Borough President Bird S. Coler, Dr. St. Clair McKelway, and the Rev. Dr. Nehemiah Boynton. In the evening a parade of military and civic organizations and a banquet at the Union League Club concluded the celebration.

The Edison Medal.

Charles L. Clarke, chairman of the Edison Medal Committee of the American Institute of Electrical Engineers, has made the following announcement:

"An important change has been made in the conditions under which the Edison Medal is hereafter to be awarded.

"The Edison Medal was founded upon the initiative of an organization, known as the Edison Medal Association, composed of old associates and friends of Mr. Edison, who subscribed a trust fund for that purpose, under an indenture, dated February 11, 1904, and entitled 'Deed of Gift Creating the Edison Medal'; whereby the Institute engaged annually to award the medal 'to such qualified student as shall have submitted to the Institute . . . the best thesis on record of research on theoretical or applied electricity or magnetism.'

"No student whatsoever having entered in competition for the medal, although wide publicity had been given to the provisions of the deed by means of appropriate notices, repeatedly sent broadcast to institutions of learning where electrical engineering is taught, the Institute became convinced that: (1) the foundation had practically been demonstrated to be a dead letter; (2) the conditions of award under the deed did not properly meet existing circumstances; (3) or insure a general competition by students representing any substantial number of the qualified institutions of learning; (4) criticism of the Edison Medal foundation had become general on the ground that it was unusual to award gold medals in the manner provided to young students at the beginning of their careers; (5) the terms of the deed ought to be changed so as to place the award of a medal in the name of Edison on a plane comparable to the award of the John Fritz Medal, the Bessemer Medal, the Rumford Medal, and others of equal renown, whose recipients have been the foremost scientists, philosophers and engineers of their time, and (6) the award ought to be made to bear a distinct relation to achievement in the electrical field.

"Thereupon, the Edison Medal Committee of the Institute was directed, in the spring of 1907, if possible to obtain such change in the deed as to make the award dependent upon 'meritorious achievement' in the electrical field.

"Owing, however, to the legal requirement of obtaining the assent of the twenty-four surviving, and widely scattered, members of the executive committee of the Edison Medal Association to the change, and their signatures and seals to a deed embodying the same, it was not until March 26 of the present year that the change was finally consummated, in a new deed, entitled 'Amended and Substitute Deed of Gift Creating the Edison Medal.'

"By the terms of the new deed the Edison Medal is no longer open to competition, but it is to be awarded 'for "Meritorious Achievement" in Electrical Science or Electrical Engineering or the Electrical Arts,' thus placing the award on the high plane where the Institute and the Edison Medal Association deem it properly belongs. The award is limited to a resident of the United States and its dependencies or of the Dominion of Canada."

Lecture Before the Schenectady Section of the American Institute of Electrical Engineers.

H. M. Wilson, chief engineer of the Technologic Branch of the United States Geological Survey, gave an exceptionally instructive and interesting lecture before the Schenectady section of the American Institute of Electrical Engineers, on April 17, on the subject of "Conservation of Natural Resources and Some Fuel Problems." The logical conclusions drawn from the statistics as to different resources and the rate of their consumption, demonstrated clearly that unless something is done for their conservation they will be exhausted in comparatively few years. Without taking into consideration the reproduction of timber, a very conservative estimate is that twenty years will see the destruction of nearly all of it at the present rate of utilization. At the present rate of increase in the consumption of iron, 200 years will see the exhaustion of it, and the same figures apply to the coal supply. Concrete and reinforced concrete seem to be the most encouraging substitutes for timber, while various methods for utilizing low-grade coals and lignites will aid in conserving the coal supply. These low-grade coals give a high efficiency when used in the gas producer, and when briquetted they form a very good fuel for domestic and power purposes. The fact that about fifty per cent of the coal is wasted in mining was brought out; also the work of this branch of the Government in finding a way to coke the different coals in the West, where a large quantity of coke is required for smelting purposes, by washing the coal. The possibilities of alcohol as a fuel were also mentioned. Alcohol, being produced from vegetable substances, is not dependent on any fixed supply, as is gasolene or petroleum, and tests have demonstrated that, under the right conditions, as much power may be obtained from alcohol as from gasolene, gallon for gallon. Many interesting facts regarding mine explosions, etc., were brought out.

Typesetting by Wireless Telegraphy.

A newspaper despatch from London, England, states that Hans Knudsen, a Danish inventor, has announced that he has perfected an apparatus by which typesetting machines in New York can be operated from London by means of a wireless telegraph system. The despatch is quoted as follows:

"I shall publicly demonstrate my new wireless typesetting invention within a few weeks," said Mr. Knudsen. "I have already had the first machine constructed, and it has proved successful, setting 3,000 words an hour at a distance just as if the operator were working the machine."

In the course of his demonstration of wireless photography at the Hotel Cecil, Mr. Knudsen sent photographs of the king, queen, and kaiser from one room through the wall into another, without wires, the pictures proving recognizable.

"I claim I can send pictures wherever Marconi can send messages," said Mr. Knudsen. "Within a short time I shall be sending pictures of criminals and finger prints from England to New York."

For a Montreal Holding Company.

It is understood that negotiations are under way with a view to organizing a holding company to take over the Montreal Street Railway and the Montreal Light, Heat and Power Company. The leading interests of the Montreal Street Railway have approved the general outline of the project, but it is not known yet whether it will be put through.

At a meeting of the directors of the Montreal Light, Heat and Power Company, M. P. Davis was added to the board, succeeding the late Lieutenant-Colonel F. C. Henshaw. Mr. Davis is president of the Cornwall Paper Manufacturing Company, Limited, and has large interests throughout Canada. The board of directors now stands as follows: H. S. Holt, president; W. McLea Walbank, Rodolphe Forget, Sir H. Montague Allan, C. R. Hosmer, Hon. H. B. Rainville and M. P. Davis.

The Iowa Electrical Association.

At the annual meeting of the Iowa Electrical Association, held at Des Moines, Iowa, April 22 and 23, the following officers were elected for the ensuing year:

President—L. D. Mathes, Dubuque.

Vice-president—O. E. Brownell, Lake City.

Secretary—W. N. Keiser, Des Moines.

Treasurer—W. A. Mall, Belle Plaine.

Executive committee—The officers and Thomas Sloss, Cedar Rapids; F. L. White, Traer, and J. F. Porter, Davenport.

The meeting was very largely attended, over 300 electrical men being present. The sessions were well attended, and a number of very fine papers were read.

Mr. Mathes, the president-elect, is one of the most popular men in the central station field, and is an active and efficient worker in the organization. He has had a wide business and technical training, and for the last five years has been general manager of the Union Electric Company, of Dubuque. He was born in Memphis, Tenn., thirty-six years ago, and was educated at the University of Tennessee. His practical electrical experience has been gained by working up through the various positions in electric light and railway operation, and through a connection of a number of years with manufacturing companies.

The re-elected secretary, Mr. Keiser, has made a fine record for the association, and it does well to recognize his efficiency by continuing him in office. He is engineer of the Des Moines Edison Light Company. His work in Des Moines began with the General Electric Company in 1900, when he became connected with the underground and central station work. He has held his present position for the last five years. He was born at Logansport, Ind., and is a graduate of the electrical course of Purdue University, Lafayette, Ind.

In his presidential address, George S. Carson, of Iowa City, referred to the general agitation against corporations in general. The present attitude of the people is wrong entirely, and he hoped for some solution of the matter which would show the injustice of this attitude and would allow money invested in corporations the same consideration as if invested elsewhere. Unless this were done the service of these corporations would be crippled and they would become inefficient. He thought that the large interests of the present day could not be financed by one man; that it requires the wealth of hundreds, and even thousands, to successfully carry on the business of some of our large companies. This capital may be represented in bonds, which are not only held here, but in many parts of the world, and also in stocks, which are likewise distributed among all classes. Because stock is controlled by some one interest it should not be condemned. It could not be otherwise and be successful. There is a natural law which will limit the size of corporations. When they become too large for control by one mind, disintegration will soon follow. Some of them to-day are so large that the head officers are breaking down under the responsibility they must carry. This can not last always, and he predicted that contraction will follow. He could not, however, give up the idea that, in the end, justice would be done, and if not, the courts could still be relied upon, and a square deal would be given to all.

In the matter of the tungsten incandescent lamp he thought that the central station had a more encouraging outlook for future increases in business. By its higher efficiency the central station man should be able to displace even gasolene competition, with which many of the smaller companies have had to deal.

One of the most interesting papers presented was by Errett L. Callahan, of the Chicago office of the General Electric Company. This was entitled "Popularizing the Use of Electricity." Mr. Callahan showed that the field for profitable residence business for daylight heating and cooking was almost unlimited. There was a great need for special solicitors, and the value of demonstrating to a new customer the advantages of a new device should not be overlooked. Attractive show rooms were also necessary.

Another important paper was entitled "Tact and System," and was presented by John W. Ferguson, of the Commonwealth Edison Company, Chicago, Ill. This subject to central station managers is one of the utmost importance. The companies should show by their methods of operating that they recognize the limitations as well as the privileges invested in their franchise rights. They should show by their acts their realization of the fact that these rights have been granted by the people, and that the latter have at all times the right to demand an account of their stewardship; that the company's duties, well and courteously performed, will disarm criticism, while these duties neglected or discourteously performed will bring disgrace to the managers and disaster to the financial interests the management is chosen to defend.

A very important link in the systematic conduct of business is the handling of mail. Letters should be very carefully investigated, and such methods adopted as will assure them prompt and careful attention both before and after the final transaction of the business called for in them. They should be carefully safeguarded, and the business having been transacted the letters should be filed away in such a manner as to be of easy access. Copies of answers to letters should always be attached to the letters when they are sent to the files. The method adopted by the contract department of the Commonwealth Edison Company is that all letters coming to the department are filed under the name of the agent. A notice is sent to the agent advising him that such a letter is on file. He may see the letter by going to the file and reading it, but under no circumstances is he permitted to remove the letter itself from the file. His report on the letter should be in writing, and should he not make a report within a reasonable time, a supplemental notice is sent in. This letter is followed up in case of further delinquency until the matter is closed. The letter is then removed from the department file and, with all the reports, sent to the general file, from which it can afterward be removed only upon written request and the signing of a receipt by the party authorized to remove it temporarily.

There is a limit to the ability and versatility of every man, beyond which he can not go. The limitation of the one-man company is spelled in the limitation of the man. The active head of the organization must be the moving force of that organization. He should surround himself with men capable not only of seeing that the duties of the departments over which they preside are properly performed, but to quickly note and fearlessly recommend such changes as they deem for the best interests of the general business. These men should form a kind of cabinet, and should, from time to time, be brought in conference to make reports as to progress and to devise ways and means. The methods of the various employés will, in most cases, be found to be in line with the methods of the head of the department. Never losing sight of his duty to the company, though at times the fulfilling of that duty may cause temporary displeasure to the customer, it is always possible to so perform the duty that the minimum amount of dissatisfaction shall result, and this should be the object of the head of each and every department of every company. The perfunctory performance of duty never produces prefer-

ment. Every employé should be ambitious to improve his position in his company. To secure this advancement he should not be content merely to do his duty, but should strive to do it better than any one else could perform the same duty. Much good or harm may be done the company in the minds of the public by those with whom the public may never come in personal contact. The introduction of the telephone in business has been at once a great blessing and a great curse. To the acquisition of the telephone is attributable much of the development of business possibilities. Unfortunately, the misuse or careless use of the telephone is responsible for a great deal of ill-feeling exhibited by the public toward public service corporations. It is one of the peculiar weaknesses of human nature that we are more or less prone to adopt at times an acrimonious or peremptory tone on the telephone which we would not dream of employing if dealing with the customer personally. This is particularly true of the junior clerk or office boy.

Important as are the relations of the office employés with the consumer, a great deal more important is the relation to the customer of the contract agent, the inspector, the collector, the meter man and the repair man. Too much thought can not be given to the address and character of these employés, for upon them rest the opinions which the customer largely forms of the company in general.

The surest way to make agents do their work is to show them that their efforts are appreciated. For this purpose managers should be careful in their promotions and rewards, and in daily dealings care should be taken to avoid slight or haphazard criticisms of any of their proceedings. Praise should be right not only in substance, but should be put upon the right foundation.

The department dealing with complaints from customers calls for a display of tact of the highest order. The customer appearing before the representative of the claim department is, from the very fact that he is there, almost always in a state of antagonism to the company. If he comes honestly to complain he feels that he has suffered an injury. He feels that, intentionally or unintentionally, the company has done him harm; that he has been asked to pay for that which he has not received; and, worse than all, he comes with the premonition that, dealing with a corporation, he is to receive no consideration, and that he must fight his battle to the bitter end. The claim man therefore should be one who will instinctively at once be able to judge the character and temperament of those with whom he has to deal. In the majority of cases it is a mistake to try to convince the claimant of the correctness of his bill at the first interview. Rather, his complaint should be carefully and respectfully listened to, and then he should be informed that a thorough investigation will be made. When this investigation has been made, the claim man should look well into the conditions and satisfy himself that, having once taken a position based upon an investigation, his ground shall be so sure that no evidence can afterward be brought to cause him to withdraw therefrom. Should the result of his investigation show that an error has been made in reading the meter or in figuring the bill, or in any other way, he should at once hasten to apprise the customer of this fact, stating to him the rebate to which he might be entitled, and make the customer feel that the company is grateful to him for giving it an opportunity to rectify the wrong. Where the result of the investigation shows that the readings are correct and that no injustice has been done to the customer, the claim man should, as far as possible, seek a personal interview, in which he may explain to the customer why the bill appears to be right, and in which he may receive from the customer information tending to show the justice of the company's position.

The economical operation of a 200-kilowatt station was the subject of a short address by Austin Burt, of Waterloo. The matter of improving the load-factor is one of the most important considerations of economical operation. The plant must be able to meet the peak load, and where the maximum load is high and the average load low, the load-factor is low, and there is poor economy. The station should strive to control the consumer, which can be done by raising the load-factor by the addition of off-peak new devices. During February and March Mr. Burt had raised the load-factor to forty-eight per cent, due to a reduced peak. A small and large unit in a station are better than one still larger unit. A great aid in increasing the load-factor is a curve-drawing wattmeter.

A very excellent paper was read by F. W. Willcox, of Harrison, N. J., on "Incandescent Lamp Development." An abstract of this paper appears elsewhere in this issue.

The paper by L. D. Mathes, of Dubuque, brought forward a number of excellent suggestions, and was thoroughly discussed. This paper was published in full in the issue of the ELECTRICAL REVIEW for May 2.

The next convention of the association will be held at Cedar Rapids, beginning the third Wednesday in April, 1909.

A $500,000,000 Electric Line Barred from the Mails.

The St. Louis (Mo.) *Star* of April 23 states that the St. Paul, Minneapolis & Seattle Railway Company, incorporated in South Dakota, with a capital of $500,000,000, for the purpose of constructing a third-rail electric railway from St. Paul, Minn., to Seattle, Wash., was, on April 23, debarred from the mails by a fraud order. The statement continues as follows:

"Three other corporations, the Co-Operative Construction Company, with $100,000 capital; the Great Northwestern Fiscal Agency, and the Northern Investment Bureau, each with the same officers as the railroad company, were included in the fraud order. All of the companies had offices in the New York Life building, St. Paul.

"The public was told that this right of way was surveyed, but the inspector says the promoters admitted that the only surveying that had been done was a seventeen-mile walk toward the Northwest, undertaken by an engineer of St. Paul. The literature of the railway company, as described by the fraud order, contained promises of from $3,000,000 to $3,500,000 profit, declared that electric trains would make the distance between the two cities in only thirty hours, and stated that an electric line at Grand Forks, N. D., had been purchased.

"When these promises had been well circulated, the post-office inspector states, a bogus contract was made with the Co-Operative Construction Company. Then the Great Northwestern Fiscal Agency and the Northern Investment Bureau were organized, and through them stock in both the railway and construction companies was offered on the market."

Interruption to Marconi System.

For the first time since the inauguration of transatlantic service by the Marconi system, last October, a serious interruption has taken place. This came about through the sudden snapping of some of the aerial wires at the Glace Bay receiving station during a heavy storm on Wednesday, April 22. The broken wires were at the top of a slim 250-foot mast, which was covered with ice and sleet, and it was not possible, due to the bad weather conditions, to make repairs at once. The accident would be trifling during good weather. It is stated that plans have been made to render impossible similar interruptions in the future.

HANDLING FARES ON INTERURBAN RAILWAYS.[1]

BY P. P. CRAFTS.

Probably the question of proper collection, registration, and auditing of interurban fares has received more attention from interurban managers than any other individual item in connection with their work.

It is fully as important to safeguard the receipts against loss through careless and inefficient methods of handling and accounting and the peculations of the dishonest employé and passenger, as to properly account for the operating expenses, if not more so.

Too many of us look upon the money obtained from traffic as so much cash received, and do not give sufficient thought to analyzing and preventing the small leaks, which taken individually may be very small, but collectively amount to a good round sum per annum. Such money is earned, but not collected nor accounted for.

For instance, a three-car road operating twelve trips per car per day of eighteen hours, and losing only ten cents per trip, will in one year be short $1,314. One half this amount expended in clerk hire or in proper ticket forms might be the means of saving such a loss.

On the other hand, some managers surround the handling and accounting of fares with so many safeguards that their expenses are enormous in proportion to the benefits derived.

The question, therefore, resolves itself down to "What is the simplest system of accounting and tickets which, with the least expense, will transfer the greatest percentage of money due from traffic to the treasury of the company?"

The answer is not nearly as simple as perhaps it may seem, because local conditions of traffic, number of stops, terminal arrangements, etc., must govern the system finally adopted.

A road whose stops are far apart and which carries mostly through traffic, *i. e.*, from one terminal to the other, may successfully adopt a system of collection and registration which would utterly fail of its purpose on a road whose stops were frequent and the local or short riding heavy. In other words, the fares lost from not being collected, on the latter line, because of a very accurate but cumbersome system of fare collection and registration, would be greater than the losses which might be sustained by the use of a somewhat less accurate system permitting quicker work on the part of the conductor.

This assertion, it must be admitted, is a very strong one, but the writer has, for several months past, operated two interurbans, one of which presents the former condition, and one the latter. The opportunity to study both conditions has therefore been an excellent one and the experience gained of sufficient value to make the above statement.

A number of so-called standard systems have been devised from time to time, some of which have been guaranteed by the originators to cure all evils in the line of fare collection, etc., but local conditions were not given sufficient consideration, with the result that some of these systems have been adopted by some roads and some by others, but none of them has been sufficiently universal to be applied to all conditions.

The most universally used systems at present are as follows:

First—The duplex check used in various forms and in various manners.

Second—A combination of the duplex check, sold only on cars, and tickets sold only in stations.

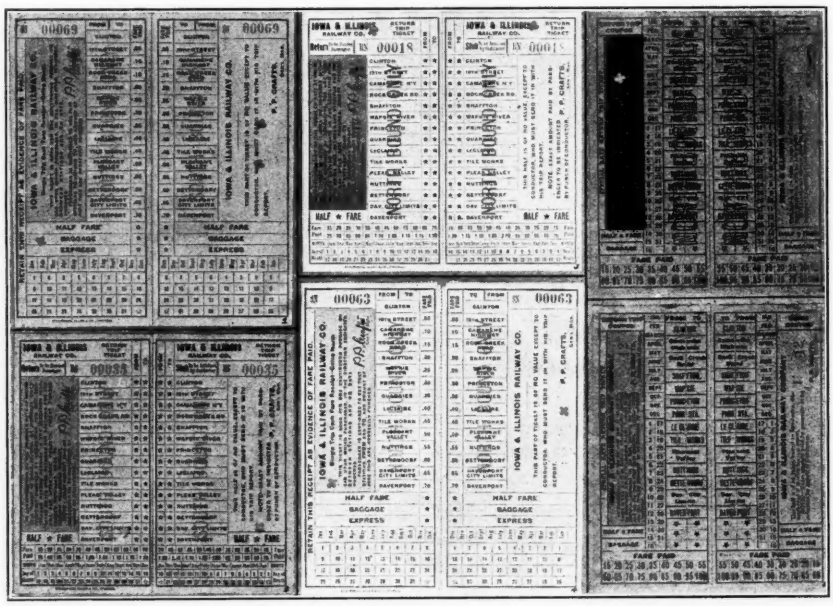
Third—The use of registers upon which can be recorded the various classes of fares collected.

Fourth—The zone system of fare collection by which fares are collected every few miles and recorded on ordinary registers.

Various other systems are in use, but the above described will be found on the greater majority of the electric lines in this country.

Probably all the different forms of the duplex check, under that and other names, have been called to the attention of all interurban managers, therefore I will not take the time to describe them in this paper, but the variety of combinations of their use are worthy of description and discussion. The general combinations are:

A.—One form of duplex check for one-way fares, with and without registers.



DUPLEX CHECKS USED ON IOWA & ILLINOIS RAILWAY.

1.—Southbound single trip duplex check, sold on southbound cars at regular rates only. Conductor gives panel half to passenger, retaining plain half. 2.—Southbound round trip regular rate duplex check. 3.—Northbound round trip regular rate duplex check, sold on southbound cars. Conductor gives panel half to passenger, retaining plain going stub. Return stub honored only on northbound cars. 4.—Northbound single trip regular rate duplex check. 5.—Northbound round trip special rate duplex check, handled in same manner as regular rate round trip duplex check. Only sold for special rates. 6.—Southbound round trip special rate duplex check.

B.—One form of duplex check for both single and round trip fares, with and without registers.

C.—Two forms of duplex checks, one for single, and one for round trip fares, in either direction, with and without registers.

D.—Four forms of duplex check, one for single and one for round trip fares in one direction; one for single and one for round trip fares in the opposite direction.

E.—In addition to any of the above combinations forms for special reduced rates, generally used on certain days only.

With any form of the duplex check a very careful record must be maintained

[1] Paper read before the Iowa Street and Interurban Railway Association, Des Moines, April 24.

of the checks issued to the conductors, and the number reported daily by them as used, and the checks turned in by all conductors whether issued by the man turning in or by some other man.

One of the most valuable assistants in checking the issuing and collecting of checks is a comprehensive trip sheet which will not require that the conductor be a bookkeeper, but upon which he can properly classify the fares collected in an intelligent manner. In that connection some roads allow each conductor to use one trip sheet for the entire day, while others require a trip sheet to be turned in at the end of each swing or at the end of each trip. The necessity of either of the latter arrangements varies with conditions, but in general and for reasons only too obvious to all managers, it is desirable to have trip sheets made up and handed in at the end of each round trip. Tickets collected should also be handed in with the trip sheets upon which they have been recorded.

To illustrate the point brought out earlier in this paper, the writer will describe the system of fare collection and accounting in use upon each of the roads which he has managed for some time past, namely, the Iowa & Illinois Railway and the Joplin & Pittsburg Railway, the former illustrating the first and the latter the second class mentioned.

On the Iowa & Illinois Railway a combination system is used consisting of duplex checks sold only on cars, card tickets and mileage books sold at the terminal offices, together with special rate duplex checks sold on cars and special rate tickets sold in offices mentioned, the latter only for special rate days and for special car parties.

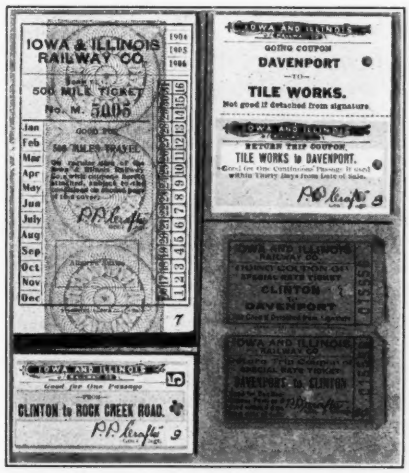
Of the regular rate tickets issued there are four forms of duplex checks, sold only on cars, one single trip and one round trip form for each direction. Four forms of terminal office tickets are also sold, one single trip and one round trip form for each terminal.

In addition a color scheme is also carried out, all tickets having colored panels printed on them. Tickets which can be collected on southbound cars bear blue panels and those collected on northbound bear red panels.

It is, therefore, necessary for conductors to change their pads of tickets at the end of each half trip and in order that they may have a sufficient supply on hand for all emergencies each conductor is provided with a small tin box, having a proper lock, in which he can keep all tickets not actually in use.

Round trip tickets are so arranged that the return coupon bears the proper color of panel for the return trip. The conductor of a southbound car sells a round trip ticket having a red panel on the return coupon, retaining the plain going coupon. The same color scheme applies to office tickets sold at terminals.

Regular rate tickets are never sold at a reduced rate, a special form being provided for that purpose. These special rate tickets are easily distinguished from the regular rate tickets both by form and color. Therefore, if conductors receive orders to sell at reduced rate between any two points they must use the special rate form of check. Inasmuch as the terminal offices only sell reduced rate tickets between termini, or between either terminal and the I. & I. Park, only two forms of special



MILEAGE BOOK AND TICKET USED ON IOWA & ILLINOIS RAILWAY.

7.—Standard form of 500-mile book sold at offices, good in either direction until used or expires by time limit. This book may be signed by three persons and is then good for one or all. 8.—Southbound round trip regular rate office ticket. 9.—Southbound single trip regular rate office ticket. 10.—Northbound round trip special office ticket, handled in same manner as regular rate round trip office ticket. Only sold for special rates.

rate tickets are sold at each of the offices mentioned.

Special rates are never made for a ride in one direction only, being made only for round trips.

In addition to a fairly comprehensive system of tickets, conductors must close trip sheets and turn in same, together with all tickets collected at the end of each round trip. This, of course, materially increases the work of auditing tickets, but it decreases the possibility of the double use of ticket stubs, against which the company is again partially protected by the consecutive numbering of each form of ticket, which also includes a letter designating whether the ticket is southbound or northbound.

We also make use of a register, but its purpose is not to register the amounts of fare paid by passengers nor to check the number of passengers on the car at any one time, except when going into or going out of the city of Davenport. This is done to comply with the terms of a terminal contract with the Tri-City Railway Company.

A daily check is kept on all tickets of different classes sold by each conductor and by each terminal office. When a conductor receives a pad of tickets he is charged with it by the beginning number. After checking through his trip sheets from the beginning to the end of his run, to ascertain whether or not the numbers of all tickets sold check with the closing number as reported at the end of the day, the closing number is entered on the ticket ledger and this number is, of course, the opening number for the following day. This same method is carried out in accounting for tickets sold by the terminal offices. When transferring tickets from the stock room to the distribution drawer, care is taken that consecutive numbers are transferred and in no case are pads of tickets bearing anything but the proper numbers allowed to be issued to the conductors or to the office.

We find it a very easy matter to check irregularities or losses on the part of conductors or agents and to trace out any tickets presented for redemption. It is very surprising to some person demanding a return of his fare on some excuse, when, after asking a few questions we ascertain that perhaps the party had picked up a receipt in a car leaving Clinton at 5.30 P. M., which receipt was left in the same car by some party riding on its 2.30 P. M. trip.

When the road was first started we had a large number of these demands, but it is now a rare thing to have a demand for a return of fare except in cases where people buying round trip tickets have been unable to use them, in which case we immediately return the difference between the regular trip fare and the round trip fare paid.

The system of using colored panels so materially reduces the chance of the double use of receipt stubs that we have never been able so far to find any evidence of such double use. This can be very readily seen when it is explained that after once selling a duplex check from one station it is impossible for the receipt stub to be again used from the same station, because the conductor's stub is recorded and

turned in before he again passes that station in the same direction. Furthermore, each conductor, knowing that the serial numbers of all tickets issued to him are recorded, is extremely careful about selling any which do not bear the proper number.

The above, of course, applies wholly to single trip duplex checks, for all office tickets are collected by conductor, leaving no receipts in the hands of passengers, and all parts of round trip duplex checks remaining with passengers are valuable to the latter. The only chance of material loss is in connection with the single trip duplex checks which are, therefore, very carefully surrounded by a number of safeguards.

We do not attempt to keep a very accurate account of the business derived at the various flag stations along the line, preferring to divide it between through and local business. From these records it is very easy to ascertain whether or not the traffic from one particular point is falling off or increasing materially. We are very careful, however, to separate northbound from southbound traffic, in order that we may ascertain whether or not the line is being used as a connecting link by traveling men, in one general direction.

Under the contract with the Tri-City Railway Company it is necessary for us to report the number of passengers going in and coming out of the city, the number of transfers issued and received. Proper spaces are provided on trip sheets for filling out these reports, same being carefully transferred to a record sheet and reported monthly to the terminal company.

Having described to you the system in use on a road whose stops average one about every three miles, I will now illustrate that such a system is not at all practicable for a road whose stops average about one for each half mile, by describing the system in use on the Joplin & Pittsburg Railway.

This road operates through a number of small mining towns radiating from Pittsburg, Kansas. The local traffic between the various towns and the morning and night traffic between the homes of the miners and their work is extremely heavy. To better illustrate the amount of local riding, I will state that the average fare per revenue passenger on this road is approximately seven and one-half cents in a maximum fare of thirty-five cents, without round trips or special rates, whereas on the Iowa & Illinois Railway the average fare per revenue passenger is thirty-two cents in a maximum fare of seventy cents, besides round trips, mileages and special rates, the last being frequently given.

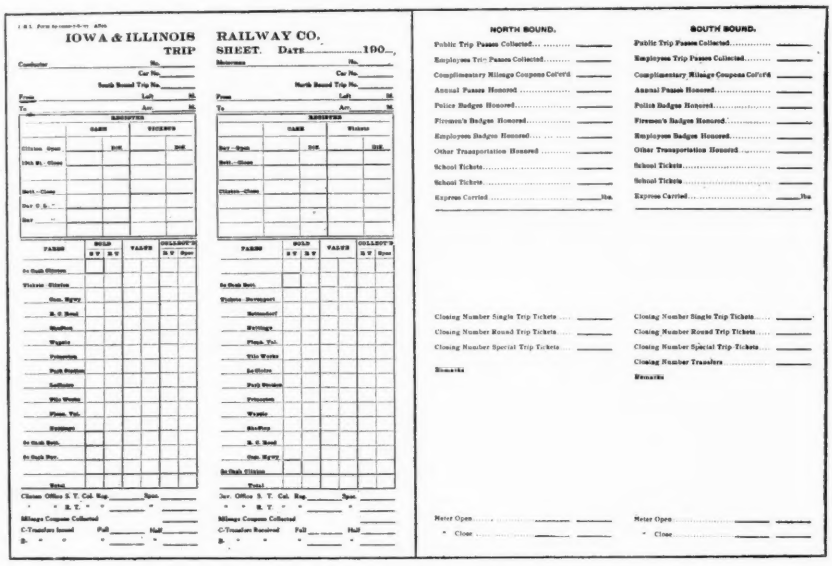
The situation on the Joplin & Pittsburg Railway was studied very carefully, and it was soon ascertained that the use of a very comprehensive ticket system would defeat its purpose, because so many fares would be missed owing to the extremely large number of local passengers handled.

A system of registration by which all classes of fares could be rung up and recorded was finally adopted, hat checks being issued to designate passengers traveling between the principal stations. This system, however, has its disadvantages, because the conductor is comparatively free to ring up any amount of fare regardless of what he collects.

This may seem like a very bold statement, but the writer has made a special study to ascertain whether or not passengers pay any particular attention to the registration of fares, and he is satisfied that a majority pay no attention to it whatever. Even should they notice the ringing of the bell, it is very unlikely that they would pay any attention to the actual amount indicated on the face of the register. The average conductor also realizes this inattention on the part of the passengers, and it is, therefore, an easy matter for one so inclined to pick up enough daily, as I have heard it whispered around street corners, for lunches, cigars and drinks.

It is also very hard, when using this system, to check conductors who are inclined to be dishonest, for unless the checker can actually see the amount paid it is difficult for him to state positively that the conductor has rung short.

The peculation of the dishonest conductor is, of course, limited to a certain extent, because he must keep a very accurate account of the number and amount of fares rung short, or his check with the register will be incorrect to such an extent that he lays himself open to suspicion at the office. He can determine in advance just how much he will take up on each trip and unless he becomes greedy enough to take a large amount or is caught by an inspector, he can make some pocket money.


IOWA & ILLINOIS RAILWAY CO.
TRIP SHEET. Date.....190..

NORTH BOUND.

SOUTH BOUND.

FACE AND BACK OF TRIP SHEET USED ON IOWA & ILLINOIS RAILWAY.

The system of hat checks, recently designed by Mr. Pierce of the East St. Louis & Suburban, obviates that trouble to a certain extent, but it again introduces a considerable loss of time in the collection of fares.

One method which would partially overcome the difficulty referred to would be to use an ordinary fare register, registering by five-cent fares. If a passenger paid 25 cents, the register would be rung five times. This method, however, destroys the means of keeping account of passengers carried.

Another partial cure is the zone system, but the writer's experience with that system has been very unsatisfactory. The zone system as a general proposition causes the passengers too much annoyance and the earnings of the road must suffer in consequence. Some managers claim to

have overcome the objection to it by collecting full fare and requiring the conductor to ring up for each passenger carried on each zone. Assuming a car carrying over two hundred people in a tri of twenty-two miles, the passengers would not be able to carry on much conversation and would hear very little else than the ringing of the fare register. This system, unless used in combination with duplex checks, also prevents an accurate accounting of passengers carried.

The accounting for fares collected on the Joplin & Pittsburg Railway is naturally a simple matter, there being no round trip nor special rates, fares between any two points on the road remaining the same. It is only necessary to check trip sheets with the registers and with cash turned in by the conductors. From the trip sheets also is obtained the number of passengers carried and the car mileage.

In conclusion I believe it is conceded that the use of the duplex checks on roads whose short riding traffic is normal is practically a success, but a satisfactory system has not been discovered for roads carrying a large proportion of local traffic. There is great room for improvement in the latter instance.

One of the most important features in connection with any system of fare collection and accounting is to keep a careful record of tickets issued to conductors and offices, to have the conductors turn in frequently enough to prevent the double use of duplex checks and to carefully audit the returns of conductors and offices. It is extremely important, of course, that the latter item shall be followed up efficiently, otherwise mistakes will occur in the auditing department in connection with the correcting of conductor's mistakes, which will not only be embarrassing but will destroy the efficiency of the auditing system. Under no condition should the handling of fares and tickets be allowed to drag in any department, because upon the efficiency of the system of accounting for receipts depends the efficiency of other departments, whose standard is set by the former.

The different forms of tickets in use on the Iowa & Illinois Railway, together with the accounting forms, are presented herewith.

St. Paul Railway to Have Telegraph.

The Chicago, Milwaukee & St. Paul Railway on May 4 organized and incorporated at Butte, Mont., the Continental Telegraph Company and the Continental Express Company, the former capitalized at $300,000 and the latter at $100,000.

Edison Electric Illuminating Company of Brooklyn Makes Important Lamp Announcement.

The Edison Electric Illuminating Company of Brooklyn entertained the local electrical contractors at its club room in the Johnston Building, Brooklyn, N. Y., on April 29, and explained to them the situation with regard to the tungsten lamp and what the company proposed to do. The main idea in doing this was to demonstrate to the contractors how the advent of this lamp makes it possible to secure an immense amount of new business hitherto unobtainable, and to give them some information and inspiration which would send them out full of determination after prospective consumers. Over 100 contractors were present, and they were addressed by W. W. Freeman, J. F. Becker, Jr., and M. S. Seelman, Jr., advertising manager of the company, on the commercial side of the question, while W. F. Wells, of the engineering department, explained the physical construction of the new lamp and the reasons for its increased efficiency. After the meeting a collation was served.

The company has addressed a circular to its consumers and to prospective customers, explaining the introduction of the metal-filament lamps and emphasizing the gain in efficiency of these newer types of lamp over the old carbon-filament lamp. In connection with the matter of supplying customers with these lamps, the circular makes the following statement:

"On account of the new methods of manufacture of these lamps and the limited quantity in which they can be produced at present, the prices are necessarily high and it is manifestly impossible for this company to furnish them upon the same basis as the carbon lamps. The policy of the company, however, is to furnish such special lamps at cost, after allowance covering the present cost of the carbon lamp furnished without charge to free renewal customers. In this way, the customer will secure all the benefit of the economy of the new lamps.

"The fifty-watt, twenty-five candlepower tantalum lamp has been furnished to free-renewal customers of this company at an extra charge of thirty-five cents each. This lamp, as also the forty-watt tantalum lamp, will be supplied hereafter, until further notice, to free-renewal customers at twenty-five cents, subject to the return of the burned-out lamps.

"The following special prices have also been fixed, until further notice, for the several types of tungsten lamps to free-renewal customers, all subject to the return of the burned-out lamps: Forty-watt, thirty-two candle-power, $1; sixty-watt, forty-eight candle-power, $1.25; 100-watt, eighty candle-power, $1.50.

"To customers who are not entitled to free carbon renewals the tantalum and tungsten lamps will be supplied at fifteen and twenty-five cents respectively in excess of the above figures."

Turbine Activities in the Far East.

No less than ten machines, aggregating 25,000 horse-power, are included in a large shipment of Westinghouse turbo-electric power equipment from East Pittsburg to the Far East. Most of these machines will go to Japan for the equipment of railway, lighting and manufacturing plants.

One of the first machines to be put in service will be a 1,500-kilowatt turbine unit for Manila, to be installed in a station with four other machines of like construction put into service several years ago. Past experience with these machines has resulted in the recent extension. It will be recalled that this railway system was engineered and constructed by the American engineering firm of J. G. White & Company.

Hardly second in importance is the large turbine station of the Osaka Electric Company, Osaka, Japan, now building. This will be one of the largest power stations in Japanese territory and will contain for the present 15,000 kilowatts in five units. Three of these machines are now being shipped from East Pittsburg. The remainder will follow as fast as they can be built and tested. The Osaka installation is under direct charge of Messrs. Takata & Company, of New York and Tokio.

In the strictly manufacturing field there are two installations in process of erection for the Imperial Steel Works of the Japanese Government and the shipyards of the Hakkaido Tanko Steam Ship Company. Two 500-kilowatt Westinghouse-Parsons turbo units will comprise an initial installation in each of these plants. This gratifying reception of American motive-power machinery in the Far East, especially Japan, may be regarded as an index of future operations where government inspection is exceedingly rigid and is exercised along lines much more detailed than in this country.

CLAIMS—METHODS OF HANDLING SAME BY ELECTRIC RAILWAYS.[1]

BY ARTHUR W. GROSS.

Claim departments of electric railway companies are conducted along similar lines; claims are handled in about the same way by all claim agents, each of course having some peculiarity of his own. It is hard to say which shows the best results. At the close of the year we observe the footings to ascertain what has been accomplished; not alone to learn the amount of money expended and the number of claims disposed of, but how much, in the way of pending claims and suits, is left on our hands to contend with.

The showing for the past year may look good from a dollars-and-cents view, in that your figures are less than the previous years, yet, if you were called upon to clean the slate—to wipe out all that has accumulated and which must necessarily be taken care of—the finish may be a bad one. So I take it there is a well-defined course for a claim agent to pursue—not only to hold settlements down to a minimum, but have a thorough and competent investigation made of every claim, and, furthermore, your constant and earnest support and co-operation with the transportation or operating departments to the end that every effort is put forth to prevent accidents.

I am not prepared to state that the method of handling claims by the Omaha & Council Bluffs Street Railway Company is better than others. However, with your kind forbearance, I will confine myself to the workings of the claim department, beginning with the happening of the accident. When the accident is of ordinary character reports are made by the trainmen during that day, upon blanks kept at the car-house office, and turned in to the foreman, who forwards them to the claim department.

Vertical files are made for each set of reports, entered numerically in a record book and filed away to correspond in a cabinet holding four years' business, being the period of our statute of limitations in Nebraska, so that everything is before us at all times.

Our superintendent of transportation immediately follows the accident from an operating standpoint, for the purpose of determining whether the same was caused through the carelessness of the conductor or motorman, and if so, the delinquent one is given a heart-to-heart talk, and it is explained to him just where he was negligent and what the result of his negligence was, or might have been, and it is impressed upon his mind that hurting men, women and children is a very serious affair.

Unless the accident is one of liability, or partially so, no investigation is carried on until a claim or demand is made. Then an investigator will interview the witnesses, obtaining written signed statements from them; also procuring a detailed statement from the claimant whenever possible.

In cases of liability, such as collisions, derailments, etc., resulting in serious injury, the trainmen are required to report to the claim department. Our policy is to get in touch with the injured or members of the family. If his condition is such as to permit of making a settlement, we attempt to do so at once; always guarding against the fact, however, of taking a release which could be attacked and invalidated on the ground of incompetency. Where it is deemed inadvisable, or a settlement can not be effected, our efforts are directed toward keeping the lawyers out, and bringing about an adjustment at the first opportune time.

One of the most successful pieces of work accomplished by us, although the most unfortunate accident the company has ever had, was where two cars came in head-on collision; the southbound car getting beyond control of the motorman while running down a steep grade, leaving the track and plowing through the northbound car on the parallel track, killing three persons and injuring, more or less seriously, forty-eight others. It required considerable time and labor to effect settlements in all of these cases, yet only one got away and into the hands of a lawyer, and that because the amount claimed was unreasonable and we were willing to chance a lawsuit.

We do not employ a regular company surgeon, but call upon various doctors when desiring examinations, thereby eliminating, to some extent, the feeling that the report or testimony is given with a view of unduly aiding or assisting the railway company.

There is very little opposition to our obtaining written medical reports, upon blanks furnished by us, from attending physicians, paying a two-dollar fee therefor.

The claims considered by all as most difficult to handle are those where reports have not been made by the trainmen, and the claim department has no record nor knowledge of the accident, except as received through the claimant or his attorney. That class of cases requires an endless amount of work before you get results, if at all.

We attempt to locate the crew, using the time schedule of cars and such other facts as have come into our possession. In some instances we send tracers to the car-houses, setting forth the details of the accident and the crews working on certain lines. The men are required to answer "yes" or "no" opposite their respective names. Occasionally we draft separate affidavits to be signed and sworn to individually. Every avenue of information is penetrated, commencing at the scene of the accident and following it up to the injured party's home, throughout the neighborhood in which he lives, and places frequented by him. Where the claim appears to be "plugged," or, rather, has the earmarks of fraud, we will fight to a finish. I am glad to say few of these cases come under our observation.

Let me ask your indulgence for my drifting somewhat from the subject matter at hand, to say a few words on the effort we are making toward the prevention of accidents. It means so much and the mutual benefit derived so great, that I am firmly inclined to the belief of its being the only method through which the red-ink entries, now so glaring upon the records of the claim department, can be made a nightmare of the past.

In explanation of that part of our anti-accident campaign which consists of talks made by the general manager or assistant general manager, superintendent of transportation, assistant superintendent of transportation and myself, to the conductors and motormen of the various divisions of our system; some of the matters touched upon are as follows:

That trainmen see and know but one side of an accident.

That they do not realize that accidents carry with them a world of sorrow, grief and hardship.

That the saving of life, limb and property should be uppermost in their minds.

That they would be staggered by the enormous outlay and expense made necessary in the settlement and handling of claims.

That it is the duty of a conductor or motorman to prevent, if possible, every accident, including those resulting from the carelessness of passengers and pedestrians.

In addition to the talks to our conductors and motormen we are also taking other steps looking toward the prevention of accidents, as, for instance, publishing

[1] Paper read before the Iowa Street and Interurban Railway Association, Des Moines, April 23.

in the newspapers a series of talks to the public cautioning them to be careful on and about street cars; placing in all of our cars a picture illustrating the right and wrong way of getting off a car, which we had made from photographs taken from life and on which we designated the right way as "safe and graceful" and the wrong way as "dangerous and awkward."

We have also enlisted the support of the principals and teachers of schools and the probation officer and his staff, in keeping boys from jumping on cars and children from playing in the streets on which there are car-tracks and also enlisted the aid of the physical director of the Young Women's Christian Association in educating the young women in the proper way to get on and off cars.

Our men show a very fine spirit in this educational campaign, and are just as eager to prevent accidents, when the matter is put before them in the proper light, as we are ourselves.

A Directive System of Wireless Telegraphy.

Two reprints from *Electrical Engineering*, London, England, dated November 14, 1907, and March 5, 1908, give an interesting but in some respects indefinite account, translated by L. H. Walter, of a new "Directive System of Wireless Telegraphy" based on closed loop circuits adapted to this purpose by F. Bellini and A. Tosi.

The familiar principles of the selective radiation and absorption of electromagnetic waves by a closed circuit is made use of as indicated in several published specifications on the subject. The inventors use waves between 300 and 800 metres long and a closed radiative or receiving aerial circuit approaching an isosceles triangle in shape, with base fifty-five metres and height fifty metres, said circuit being in a vertical plane.

It is claimed that the selective tuning properties of closed circuits so used more than compensate for their necessarily small coefficient of radiation when distances ordinarily used in the radiotelegraphy are to be bridged. With 500 watts employed and a station at Dieppe sending out waves whose energy was varied, it was found possible to send at will selectively to either Barfleur, 170 kilometres (about 105 miles), or Havre, ninety kilometres (about fifty miles) away and bearing twenty-three degrees from the former "path of transmission."

It is evident that the inventors used a series connected detector, and three polar diagrams of the energy transmission along different planes through the axis of a closed radiating circuit to a single receiving vertical seem to indicate some uncertainty as to nature of the detector's response to electric waves, *i. e.*, whether an intergral effect or a "maximum value of field" effect causes the response in the detector used, the "electrolytic." In view of recent investigations on the electrolytic and its behavior in wireless telephony the inventors have assumed correctly that this detector responds principally to the maximum of the field. Pickard, Ives, Schloemilch and others have shown this. No integrating detector kept at a continuous average "response" value will further and clearly respond to higher voice harmonics or ripples giving a heat effect; on the other hand, with high spark frequencies instead of continuous oscillations this is possible, since the action starts uninfluenced to a great extent by its previous state at each new wave train.

Consideration of the fact that the maximum of the receiver field may be several times that of the inducing field owing to resonance would suggest that the usual shunt connection for the "electrolytic" detector would have been preferable.

The receiving station also was next equipped with the closed aerial and it was found that with both closed aerials in one plane a small change in azimuth of the receiving aerial nullified the reception of signals. The authors stated that this critical angle was smaller, other things being equal, for an integrating than for a "maximum" induced field detector; this is to be expected as the rate of decrease of the effect in the former case is in general twice that in the latter.

The real developments of this system are more fully shown from now onward. We are first shown at the transmitting station a pair of mutually perpendicular crossed closed aerials with an inductance coil included in each, also mutually perpendicular, and a primary related to the usual spark-gap condenser and transformer, all three coils being codiametral. The effective plane of transmission is rotated instead of the verticals. The primary coil is said to induce currents of not only different strengths in the two closed verticals but different phases. As the dimensions of the verticals are not more than about one-sixth of the shortest wavelength used, it is difficult to see in the above description any disclosure of means for producing an experimentally measurable difference of phase in the closed aerials or "loop verticals." Each oscillator, vertical loop or so-called "magnetic-doublet" throws off an interlinked system of magnetic and electric rings which rapidly coalese in phase to form the usual wave, and any pair of loops with a common centre will have their phase differences if arising from the shortness of the operating wave, practically negligible in amount; said phase differences being in the above disclosed apparatus injurious rather than otherwise. This is a purely technical point and need not detract from the consideration due to the really important claims of the inventors which include freedom from "static," sharpness of tuning, small absolute energy used, and the ability to rotate the "effective transmitting plane" of the waves emitted without shifting the planes of the mutually perpendicular radiating loops. In reception of signals an accuracy of one degree or one-tenth of a point is claimed. Comment on this remarkable claim is unnecessary until commercial work has shown what the system is capable of when surrounded by the disturbing influences of adjacent buildings, ships and other stations. Actual tests on vessels of the United States Navy have shown an accuracy of one-half point at about forty-five miles for a directional system of the Stone Telephone and Telegraph Company with open aerials separated by less than one-half and more than one-quarter wavelength. It is stated that the bearings of a large number of wireless stations in the Channel have been determined, though to what degree of accuracy is not stated.

The second paper on the system is devoted mainly to a simple mathematical exposition of the use of the above circuits, which are styled "radiogoniometers." A subsidiary use of this apparatus is the convenient measurement of the angular distribution of radiant energy in azimuth which may settle some mooted questions of the day in regard to distortion of the electromagnetic field by specialized types of verticals now used.

It is evident that a larger degree of coupling is used in the circuits than is common practice in inductively coupled systems where a selectivity of ten per cent or more is desired, the resulting broadness of tuning being probably neutralized by the shape of the resultant field diagram when the receiver is properly oriented, as well as the persistency of oscillation of the closed aerials *per se*.

A polar diagram of received energy is mentioned which checked the transmitter diagrams of field intensity and energy. The apparatus permits a rapid transition from directional to non-directional operation without disturbing the tuning constants and is fairly compact.

O. C. Roos.

Electrical Notes from Great Britain.

(From Our British Correspondent.)

VERY many have been the proposals made at different times for the utilization of the vast peat bogs of Ireland by those who believed that the promotion of new industries as a result thereof would help largely in bringing about that better state of things which everybody earnestly desires for the Emerald Isle and its people. The subject has been fully investigated both by official representatives and by others, but with little tangible results. In recent years, however, workers in other countries have made progress with systems for satisfactory and economical utilization of peat as fuel, and a new effort has now been made to carry through a scheme known as the Dublin and Central Ireland electric power scheme, which proposed to use peat, on a process now at work in Germany, in the cheap generation of electricity for supply in certain portions of Dublin, Kildare, King's County and Queen's County. A generating station was to be put down at Robertstown, approximately central to the area, and 500 acres of peat bog nearest to the works was to furnish peat for a long period, the peat gas being used in gas engines driving electric generators. The power was to be transmitted by overhead wires carried along the banks of the Grand Canal. The cost of electric generation was estimated at very much lower than would be possible when using coal fuel, 0.05 penny per unit being mentioned, and this, it was thought, would bring industries to the neighborhood in the same way that factories have clustered around Niagara. Although the details of the scheme are undoubtedly interesting, that is not sufficient to secure the approval of Parliament, and the committee which had to weigh the merits of the scheme has refused to pass it. The two points upon which it appeared doubtful were the practical character of the undertaking and the probability of sufficient financial support being forthcoming if the bill were passed. For this year, therefore, the proposal falls to the ground, but it will be surprising if it does not come forward again in 1909.

According to the latest information, the electrical industry of this country will have no representative or organized exhibit of its manufactures at the Franco-British Exhibition, which opens next month and remains open until November. It will be remembered that when the Institution of Electrical Engineers tried to work up an interest in the trade it had a very chilling reception, as manufacturers, especially those supplying the heavier classes of manufactures, were indisposed to spend much money upon a big popular entertainment show. The next move made in the matter was an endeavor to promote a co-operative electrical exhibit demonstrating generally the manifold applications of electricity. Various electric lighting companies in the metropolitan district came forward with certain financial assistance, as they reasonably hoped to be gainers from the better electrical education of the public. About a score of suppliers of lamps, fittings, devices, telephones, and so forth, also gave in their names, but now the whole thing seems to have fallen through. The exhibition is to be opened by the King in about a month from now, so that there is little hope that electricity will be in evidence as an exhibit, though naturally in these days of electrical illumination electric lighting effects will be on practically every hand at such a show. Gas is making a very special exhibit. Doubtless one reason why the effort of electrical co-operation has failed is that our manufacturers prefer to devote their attention to the Manchester Exhibition of September-October next, but even for that there is less enthusiasm than is desired, if reports be correct.

The National Telephone Company has rebuilt its "Gerrard" exchange, in this city, and the new equipment is of the most up-to-date central-battery type, and when completed will be capable of serving 10,400 subscribers. The latter at present number 6,708, with 20,821 stations. There are 1,917 junction lines to other exchanges, eighty-eight operators' positions and an operating staff of 326 members.

The names of the members of the Parliamentary Committee on London Power Bills are announced. Lords Cromer (chairman), Welby, Lytton, Cobham and Lamington are named. The second of these knows from practical experience the attitude of progressive London county councillors, and the third ought to know the whole problem intimately, seeing that he was a member of the 1905 Power Bill Committee.

Professor Larmor is to deliver a special discourse before the Royal Institution on "The Scientific Work of Lord Kelvin," with experiments and typical apparatus illustrative of his discoveries and inventions. Lord Rosebery has just been adopted as chancellor of Glasgow University—an office vacant by the death of Lord Kelvin. Under his will his late lordship leaves personal estate amounting to $810,000. All of his property, including his patent-rights and good will in respect of inventions other than those which belong to the firm of Kelvin & James White, Limited, the makers of his numerous instruments, etc., he has left to Lady Kelvin.

The courts here have been occupied with an action brought against the Marconi Wireless Telegraph Company, Limited, by a Dutch banking firm (Buitenlandsche Bank) for failing to carry out an alleged agreement of last year concerning the working of a number of wireless stations in the Dutch East Indies and the provision of capital for a new company—the Sanfil Company. It was stated that as the Marconi Company failed to fulfil its obligations in the matter, the concession from the government was canceled. The Marconi Company, however, contends that it was justified under the agreement in transferring its obligations, etc., to any company formed for the purpose. The judge found that the Marconi Company was not liable in the matter, this decision being based upon correspondence that had been put in, and he gave a verdict in its favor.

It is early days yet in the liquidation proceedings of Bruce, Peebles & Company, Limited, but the liquidators and a committee of creditors, consisting of leading representatives of electrical industrial firms, are at work investigating affairs. As a first rough estimate the liquidators say that there may be 6*s.* 6*d.* in the pound for unsecured creditors. A statement of the approximate values of assets in certain events was recently submitted to a meeting in London. It showed that the approximate value of the assets in the books at the date of liquidation was $2,270,000; in the event of a reconstruction they might be worth $1,720,000; in

the event of realization and active liquidation, they could not produce more than $650,000. As the liabilities in the books (including shareholders' capital, debentures, money owing, etc.) figure at $3,090,000, there is a book deficiency of over $800,000. When the committee has gone fully into the affairs, a further meeting of creditors is to be called and one will then be better able to judge whether a reconstruction scheme is justified or worth while. The company had built up a good name abroad and business is now resulting from enterprise displayed in this direction, but as it is so often being said that British electrical manufacturing works' capacity is far in excess of the present needs, the electrical firms who are large creditors may be disposed to accept a mere break-up price for their debts in order to clear a competitor out of the way.

The electrobuses that are running in London continue to give considerable satisfaction, and they appear to be greatly preferred by the public. The Electrobus Company has other 'buses preparing for an extension of the service to Willesden and West Ham, where it can obtain current for charging at less than 5*d.* per unit. The company ran one of its 'buses from London to Brighton on one charge of the battery, on Easter Sunday. It is understood that the only troubles *en route* were three stops for adjustment due to a tight chain causing overheating of an axle. A test on arrival showed that the battery would have been equal to a further seventeen-mile run, making the total distance sixty-nine miles. The 'bus is to be put in public service at Brighton.

The British Aluminum Company has just issued its statement for 1907, from which it appears that owing to the slump in copper in July last, and to the resulting demoralization in the metal markets generally, there was a decline in profits, which during the preceding five years had shown continuous expansion. Not only did prices decline sharply, but there was, it is pointed out, a severe contraction in the demand for all metals for several months subsequently. There has been no recovery in the price of aluminum, so that the company has taken its metal into stock at a much lower price than in previous years. Orders are, however, now coming in more freely, and an improving demand is expected. The company's temporary aluminum works at Leven commenced producing in December last, and those at Stangfjord in January, 1908. In regard to the permanent power scheme at Kinlochleven, to which reference was made in these notes some months ago, there is no prospect of any power being derived from this prior to the summer of 1909, when the various sections of the work will be completed to enable the production of aluminum to commence. The village of Kinlochleven is being erected. The company, it may be remembered, last year took in hand the Orsières power scheme, and it has now entered into a contract for the first section of the hydraulic works there.

It is announced that the Board of Agriculture has shown its interest in a promising department of electrical investigation by making a grant of $250 to the department of economic biology at the University College, Bristol, for carrying on its experimental investigations concerning the effect of electricity on plants. Several English scientists are at present interesting themselves in this hitherto too-much-neglected subject, and it is hoped that results of practical value may be forthcoming before very long. The grant named is a paltry sum, but any encouragement is better than none, and if the results are found to justify it no doubt there would be little difficulty in the way of securing bigger grants later on.

A number of tramway authorities, engineers and journalists inspected, on April 10, the London County Council subway from Aldwych to the Victoria Embankment. By the opening of the second portion of this subway the first direct means of communication between the council's tramway systems on the north and south of the Thames, respectively, has been established. The tram lines in the subway are exactly similar to those in the earlier portion opened in January, 1906. The cars are single-deckers, seating thirty-six passengers, and they are constructed of non-flammable material throughout. Special care had to be given to the matter of ventilation, and ventilators are arranged the full length of the clerestory to open simultaneously, so that the air is driven into the car from the front end and expelled at the other. The trucks are maximum-traction bogie type, with steel tires. Hand brakes and electromagnetic track brakes are installed, and life guards of the swinging gate pattern are provided. To drive the subway cars energy is obtained from the council's substation at Holborn. The cables are in a pipe subway laid alongside the tramway subway. Signaling apparatus has been installed which will prevent one car leaving the Holborn station until the preceding car has left the top of the incline, and *vice versa*. The signals are operated automatically by means of two switches through strikers fixed on the cars themselves. Mr. Fell, the council's chief tramway officer, designed the cars and their electrical equipments.

Arrangements are making progress for the annual congress of the British Association for the Advancement of Science, which takes place early in September next in Dublin. Dugald Clerk, the well-known gas-engine expert, is to preside over the engineering section. In 1909 Winnipeg is to be the meeting place. The Incorporated Municipal Electrical Association is to meet at Nottingham in June for its annual convention. Some municipal councillors begrudge their engineer and committee chairman this opportunity for meeting together with others interested in undertakings similar to their own. Some Londonderry councillors argued against it on the ground of the expense, but when their engineer put before them an actual example of money saved during this past twelve months as the result of an informal conversation with some of his confrères at last year's convention, the objection was silenced.

ALBERT H. BRIDGE.

London, April 29, 1908.

May Limit Transfers.

The Court of Appeals, at Albany, N. Y., in a decision handed down on April 24, decides that a street railway company has the right, under Section 104 of the Railroad Law, relating to transfers, to regulate by any reasonable limitation the carriage of a passenger upon its line for a single fare. The case at issue was that of Peter C. Kelly against the New York City Railway Company, which arose out of the refusal of a conductor on the Eighth Avenue line, New York city, to accept a southbound transfer upon a northbound car, in accordance with the rules of the company.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., for deliveries of electrical material as follows: May 12, ten microscopical outfits, Washington, D. C.; one switchboard, Boston, Mass. May 19, miscellaneous fuses and fuse wire, Portsmouth, N. H.; 1,000 pounds hard sheet fibre, Boston, Mass. May 26, 300 dry batteries, 200 pounds sheet fibre, six glue heaters, miscellaneous supplies, Puget Sound, Wash.; miscellaneous supplies, Mare Island, Cal.; miscellaneous wire, San Francisco, Cal.

Electrical Notes from Europe.

(By Our Special Correspondent.)

A PROJECT is on foot for a series of hydraulic plants in Italy which will have a combined capacity of 200,000 horse-power. These are all to be located in the Brescia Province, and will use the water coming from the glaciers of the Camonica Valley, also the outflow from Lake Arno, which lies at 1,792 metres altitude. An 880-metre fall will be secured from the lake by means of a flume, and a turbine station is to be located for this purpose at Fresina. It is to have a capacity of 80,000 horse-power. After leaving this plant another flume will take the water, which is united with another flow from the Adame and the Salarno, and the whole supply will be taken by a canal which brings it to Cedegolo. At this point there will be erected a plant which will use a 500-metre head of water and will have a capacity of 60,000 horse-power. On the other hand, it is proposed to erect a turbine station which will use the outflow from the Salarno Lake, which has 2,038 metres altitude.

A Danish firm had the original idea of giving insurance upon losses which may be caused by non-delivery or errors in telegrams, seeing that at present there can be no damages recovered from the governments who control the lines. A contract can be made with the insurance firms by the year, but a single telegram can also be insured. This is done by purchasing stamps at the telegraph window of the post-office and placing the proper number upon the telegram at the time of sending it. These stamps are issued by the firm, who has made an agreement with the State Postal and Telegraph Department to this effect.

The Automobile Club of France is organizing an exposition at Bourges for next summer, which will be devoted to explosion motors for agricultural purposes, including motor-dynamo groups. It is especially desired to promote the use of home-produced alcohol for operating the motors. The exposition is to be held for a period of ten days. One of the main features will be the official tests which are to be made upon motors for agricultural use. In this way the advantages of the system will be brought before the rural population in a marked way.

A syndicate has been formed in Germany for operating the new tramway lines in the city of Hamburg, by the combination of the Siemens-Halske and the Allgemeine Gesellschaft. The syndicate will be capitalized at $3,500,000. A concession for the new lines has been obtained from the Parliament of Hamburg, and it has been granted for seventy years.

As regards the progress of radiotelegraphy in France, it is to be noted that at present there are two coast stations in operation for commercial messages, one of these being located at Wissant on the north coast and the second at Porquerolles, on the Mediterranean coast. At the end of this year there will be two other posts ready to operate. One of them lies at Saintes-Marie's, in the region of Marseilles, while the other is near Algiers, at Fort de l'Eau. The state, which operates all the plants of this kind, proposes to increase the capacity of the plant at Wissant so as to make it an extra powerful station, and this will no doubt be carried out during the present year. For next year two new stations are planned, one at Nice and the other at Cape Corse, on the Mediterranean. However, France possesses a number of other radiotelegraph posts, which are used exclusively for military purposes. Among these are the plants erected within a recent period at St. Matthieu, Parc au Ducs, Lorient, Toulon, etc., with a total of seven military posts. Besides the above, it is proposed to erect commercial stations at Havre, Boulogne, St. Nazaire and La Coubre, the first two lying on the Channel coast and the others on the Atlantic. We have already mentioned the high-power plant which is to be erected at the Eiffel Tower, which includes an underground station of considerable size. According to a recent decision, the different radiotelegraphic posts in France will be operated by the various departments according to their character. For instance, the Postal and Telegraph Department will have charge of the commercial stations on the coast which are used for the international service, while the Navy Department will control the military marine stations. The War Department has its special posts, including the Eiffel Tower station, which serves as a centre for the system. Another section comprises the stations of the lighthouses, and these are controlled by the Public Works Department.

A novel use of the tramway is the funeral train which is being run by the municipality of Milan. This is done in order to have a convenient means of reaching the cemetery, which is located some miles outside the city limits. A double-track road has therefore been constructed especially for the purpose, and the trains are run at one-hour intervals. The motor-car is fitted up as a funeral car and will, besides, seat eight persons, while there is a trailer with the car. Besides this, there are ordinary trains run upon the line at twenty-minute intervals. The present line connects with one of the principal sections of the city tramways which ends at the main railroad depot.

It is reported that a company has been formed at Tokio for the purpose of constructing an underground tube railway for the city, which will be built after the idea of the London subway. The company is capitalized at $7,000,000. Another enterprise in Japan is a large hydraulic plant which it is proposed to erect between Kyoto and Osaka. It will have a capacity of 50,000 horse-power. At present Japan possesses over a hundred hydraulic plants, and some important work is soon to be carried on. Among the new plants we may mention the turbine station to be erected for the city of Tokio, on the Tamagawa River. It is to supply 30,000 horse-power, which will be transmitted over a 40,000-volt pole line to the city, at a distance of twenty-five miles.

C. L. DURAND.

Paris, April 22.

American Society of Mechanical Engineers.

An interesting meeting of the American Society of Mechanical Engineers will be held on Tuesday evening, May 12, in the Engineering Societies Building, New York city. Henry Souther, of the Henry Souther Engineering Corporation, Hartford, Ct., will read a paper entitled "Clutches," with special reference to the types used on automobiles. Lantern slides will be used to show the development of this apparatus. The discussion of the subject will be continued at the semi-annual meeting of the society, at Detroit, Mich., June 23-26.

FINANCIAL REPORTS OF ELECTRIC COMPANIES.

AMERICAN LIGHT AND TRACTION COMPANY.

The American Light and Traction Company has issued a statement of earnings covering the three months ended March 31, as follows: Earnings on subscribing companies' stock, $600,463; miscellaneous earnings, $58,630; gross, $659,093. This compares with $628,015 for 1907, and $602,019 for 1906. The expenses were $12,000, the same as in 1907 and in 1906. Preferred dividends amounting to $213,543 were paid for 1908, and for the same period in 1907. In 1906 the dividend allowance was $212,650. The common dividend in 1908 was $101,410; in 1907, $84,509, and in 1906, $67,428. The surplus for the quarter was $332,140, and $176,500 was set aside for reconstruction reserve. The net surplus for the quarter was $155,640. The surplus for the year ended March 31, 1907, was $2,631,607. The net earnings for the twelve months ended March 31, 1908, were $2,457,674. The total dividends for the year ended March 31, were $1,259,814. The amount carried to reconstruction reserve for the year was $681,000, making the profit and loss surplus on March 31, $3,148,467.

NORTHERN OHIO TRACTION AND LIGHT COMPANY.

The Northern Ohio Traction and Light Company's report for March and three months is as follows: March gross, $129,659; expenses, $81,273; March net, $48,386. In March, 1907, the gross was $133,834; expenses, $78,585; net, $34,582. March charges for 1908 were $43,953, compared with $41,290 in 1907 and $39,947 in 1906. Three months' gross for 1908 was $376,085, compared with $375,883 in 1907, and $334,607 in 1906.

MONTREAL STREET RAILWAY COMPANY.

The Montreal Street Railway Company reports as follows for the month of March and the six months (October 1 to March 31): March gross, $288,674; expenses, $202,390, leaving net of $86,284, as compared with $86,127 for the same month of 1907. Interest, rent, etc., amounted to $52,257, leaving a surplus of $34,027, as against $42,915 last year. Gross for the six months was $1,747,137, compared with $1,599,048; expenses, $1,145,866, compared with $1,073,657; net, $601,271, against $525,391. Interest, rent, etc., totaled $272,282, leaving a six months' surplus of $328,989, compared with $286,513 for 1907, and $299,066 for 1906.

The company has declared the regular quarterly dividend of one and one-half per cent, payable May 15, to stockholders of record April 30.

MICHIGAN STATE TELEPHONE COMPANY.

The Michigan State Telephone Company reports the following statement of earnings for the two months ended February 29, 1908: Gross, $528,166; expenses, $397,755; net, $130,411; interest charges, $69,686; surplus, $60,725; preferred dividend, $22,832; net surplus, $37,893. The last-named figure is at the rate of 6.4 per cent on the $6,000,000 common stock.

BIRMINGHAM RAILWAY, LIGHT AND POWER COMPANY.

The Birmingham (Ala.) Railway, Light and Power Company reports gross earnings for March of $177,003, net earnings of $64,317 and a surplus after allowing for interest charges and reserve funds of $21,454. The gross earnings for three months were $522,090 and net $173,753, while the final surplus was $43,585.

MEMPHIS STREET RAILWAY.

The report of the Memphis (Tenn.) Street Railway Company for the year ended December 31, 1907, shows gross income of $1,604,384; expenses and taxes, $1,007,151; interest, etc., $404,822; preferred dividend, $125,000; net surplus, $67,411, equal to 2.68 per cent on the $2,500,000 common stock. The amount set aside to reserve fund was $30,000. The total profit and loss surplus was $37,411.

UNITED RAILWAYS COMPANY.

The United Railways Company of St. Louis, Mo., reports gross earnings for March of $858,908; expenses, $559,135; charges, $233,290; March surplus, $66,483. The gross for three months was $2,461,760; expenses, $1,633,044; charges, $700,162, making the three months' surplus $128,554.

TWIN CITY RAPID TRANSIT COMPANY.

The report of the Twin City Rapid Transit Company for March and three months ended March 31 shows as follows: March gross, $484,622; expenses, $252,824; net, $231,798; interest, taxes and preferred dividends, $123,386; March surplus, $108,412. Three months' gross amounted to $1,408,458; expenses to $764,668; interest, taxes and preferred dividends, $368,130; three months' surplus, $275,660. This compares with $315,870 for the corresponding period last year.

HUDSON RIVER ELECTRIC POWER COMPANY.

The Hudson River Electric Power Company has issued a report showing six months' net earnings of $353,285. This compares with $204,041 in 1907, an increase of $149,244. The March gross was $105,409, an increase of $25,720 over 1907. The March net was $50,323, an increase of $24,545 over 1907.

DETROIT UNITED RAILWAYS COMPANY.

The report of the Detroit (Mich.) United Railways Company for the month of March and three months ended March 31 is as follows: March gross, $529,236; expenses and taxes, $338,294; March net, $190,942; other income, $4,552; total income, $195,494; charges, $134,714; making the March surplus $60,780. This compares with a March surplus of $74,456 in 1907. The three months' gross was $1,503,827; expenses and taxes, $1,009,813; charges, $405,383; total income, $508,495, making the three months' surplus $102,612. The surplus for the same period of 1907 was $144,882.

MEXICAN TELEGRAPH COMPANY.

The annual report of the Mexican Telegraph Company for the year ended December 31 shows net earnings of $865,368, equal to thirty per cent on the $2,879,100 capital stock outstanding. Dividends were declared to the amount of $287,010. The surplus for the year is $578,358, which, added to the previous surplus, makes a total surplus of $2,381,895. The total receipts were $1,047,531. The total deductions were $182,163, divided as follows: Operating expenses, $133,685; sinking fund, $6,027; Mexican government, $32,500; cable used in repairs, $9,951.

KNOXVILLE RAILWAY AND LIGHT COMPANY.

The gross earnings of the Knoxville (Tenn.) Railway and Light Company for March amounted to $46,521; operating expenses and taxes, $23,251; interest charges, $11,623; leaving $11,647 surplus. Three months' gross was $128,017; operating expenses, $73,346; interest charges, $34,468; surplus, $20,203.

CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY.

The annual report of the Central and South American Telegraph Company for the year ended December 31, 1907, shows gross earnings of $1,749,045; expenses, etc., $556,666; net earnings, $1,192,379, equal to 11.9 per cent on the $10,000,000 capital stock. Dividends were declared to the amount of $551,031, and renewals amounted to $33,412. The surplus was $607,936, which, added to the previous surplus, gave a profit and loss surplus of $2,478,386.

Some Suggestions from the Call-Boy.

To the Editor of the Electrical Review:

If you can hear above the clatter of the telegraph instruments and care to chat a few moments with the night call-boy, all right. I like to read of Edison, who went up the grade like a sleek passenger engine, who with energy and nerve gave the throttle a couple more notches and plunged on and on in the darkness over an unknown track. They say he is an old man now, and I suppose he will die and I will never get to see him, but his achievements can never be forgotten. Here are his inventions all about the office. We pin carbon paper about the incandescent lamp so it will not shine so bright. There is the quad wire, two messages going each way at the same time; two counter-currents working through a neutral relay, says the operator, but I don't understand that. There is the carbon transmitter on the telephone, with which I saw one of the head men talk to New York city. There are relays, repeaters and condensers. Two Edison bipolar dynamos in the power-house one block away have been pulling the street-cars for the past seventeen years since 1891; just six years after the first electric street-car system was built in America at Brooklyn. Two smaller bipolar machines supply the incandescent lights; one Brush and two General Electric machines have been added of late years. Yet great as Edison was and is, and as hard as he worked, serving us faithfully even in the autumn days of his life, he could not do it all. Kelvin, Bell, Tesla, Brush, Thomson, Röentgen, Hewitt, Marconi and a score of others seem to parallel his lines.

What electrical invention is more commonly used and is as far reaching as the telephone? What does it mean to the call-boy? It means this much—that if a few more of the train men had telephones the call-boy could be dispensed with. I often call a train, engine and crew of five men in six minutes. An hour later a big freight train of forty cars goes thundering through the town.

About a year ago a train was held up at Cornell Junction, about thirty miles south of here, one passenger being killed. The lady operator handed me a typewritten copy giving full particulars twenty minutes after the hold-up. Almost the same moment our special agent (detective) came in to get full information. I never even asked how he got the news so quick. I called the chief of police of this city, Fort Scott, Kan., and read him the message. Then I called the constables of the smaller surrounding towns and advised them. Then the despatcher asked me to get an engine and bloodhounds started to the scene of the robbery as quickly as possible. I called the chief of police again and a number of parties in town, but it seemed that no one had bloodhounds or knew where there were any. Then it occurred to me that I could call up farmers on the farmer lines, so I began ringing up some old-time hunters down on Drywood, eighteen miles away, several of whom live in the hickorynut jungles that extend for half a mile on either side of the river. However, I did not locate bloodhounds, but the other fellow did by the same method, and they were hurried to the scene of the robbery and killing. Just calling anybody and everybody within a radius of twenty miles! How impossible this would have been 100 years ago! Let us listen a moment to the telegraph instrument. St. Louis is talking to Pueblo on one wire. The despatcher is calling down a young operator on another. "What do you mean by guessing at train orders?" he says. But I must not tell stories out of school.

But it is principally of the distribution of power that I wish to speak. I am wondering why the farmer could not be supplied with power over his telephone line. The lines are constructed of number ten and fourteen iron. If this would not carry enough alternating current for a three to eighteen-horse-power installation from one to six miles away—add an auxiliary wire. If this is impossible, could it not be arranged to put up a power wire on the same poles, which are already up? But I must leave these problems to the electrical engineer. Yet there are no hard problems to solve that are not already solved. Now, suppose a power line was run direct to Fort Scott from Pittsburg, forty miles south of here, in the coal-mining district, then west to Wichita through the gas fields, where gas can be had for five or six cents a thousand. This line would be 198 miles long and could supply twenty-five or thirty telephone exchanges, both Bell and Independent, with power to be distributed over the farmer lines or power lines on the farmer-line poles. Now, if it is possible to transmit power over a telephone line, the wire being slightly enlarged, why could not the farmer telephone to the central for power as he needs it, allowing it to be transmitted on the same circuit?

In an article in your paper of March 28 the writer states that the farmer does not use much power. Now, that depends on what you call much power. Installations on the farm will run from three to eighteen horse-power, larger on an average than the installations of this city. The farmer has one to twenty horses, not to look at, but for the purpose of furnishing power. The horse and the plow primarily produce the wealth of this section. Yet farm work is slow and laborious and will continue to be so until the mechanical and electrical engineer comes to his rescue, says the farm paper. Even the horse does not furnish all the power required by the farmer. In this county there are about 300 cream separators; several dozen steel burs; a number of sawmills. There is wood to cut, coal to dig, water to pump, hay to bale, corn to shell, wells to drill, rock to crush and roads to macadamize. There is the cider mill, grindstone, emery wheel and washing machine. He is obliged to light and heat his house by some means—why not by electricity? The farmer has use for every kind of a machine, from a coffee mill to a threshing machine. He has bought every conceivable kind of a machine that he can turn with his hand, windmill or horse-power, and is in the market for more. He is tolerably well to do and can afford to install the necessary machinery.

Many farmers of this section have from $2,000 to $4,000 worth of buildings on their farms and frequently the same value in cattle and crops. Why not arrange to supply the farmer with the alternating current, then sell him an induction motor? Fred Myers,

Missouri Pacific Call-Boy.

Fort Scott, Kan., April 21.

Laboratory Assistant, Bureau of Standards.

The United States Civil Service Commission announces an examination on June 3 to secure eligibles from which to make certification to fill such vacancies as may occur in the positions of laboratory assistant in the Bureau of Standards, at salaries varying from $900 to $1,200 per annum, and vacancies requiring similar qualifications as they may occur in any branch of the service. The duties in connection with these positions are identical with those of the assistants in the physical laboratories of scientific and technical institutions. As far as practicable, appointees are assigned to work in the subjects for which they are best fitted. Applicants should apply for application form 1312. No application will be accepted unless properly executed and filed in complete form with the commissioner at Washington, D. C., prior to the hour of closing business on May 23.

Thirty-Million-Dollar Mortgage Filed by the Interborough Rapid Transit Company.

A mortgage for $30,000,000 was filed on April 28 by the Interborough Rapid Transit Company with the New York County Registrar, in favor of the Morton Trust Company. The mortgage covers a lien on the Interborough Rapid Transit Company and also on the property of the Manhattan Railway Company, and a lien upon other properties, real and personal. It is dated as of November 1, 1907, and is to run forty-five years and never to exceed a principal sum of $55,000,000.

The filing of the mortgage is a part of the plan of issue of the $25,000,000 Interborough notes for which J. P. Morgan & Company are receiving subscriptions. The notes are to be convertible on any interest date, at the option of the holder, during a period of two and one-half years from date, into mortgage bonds of the company at par less one per cent, and are to be secured by pledge under trust agreement with the Morton Trust Company, trustee.

This issue has been made possible through the decision of the Public Service Commission, just handed down. The commission has made a careful investigation into the company's financial conditions and prospects, and evidently reached the conclusion that the property and earnings of the company form ample security for the bonds proposed to be issued. In the course of the opinion the commission says:

" . . . For these purposes the commission has made and concluded such inquiry or investigation, held such hearings and examined such witnesses, books, papers, documents and contracts as it has deemed to be of importance in enabling it to reach its determination. The accountants employed by the commission have examined the books, accounts and vouchers of the petitioner, and have analyzed the equipment account down to December 31, 1907, and all of the important and material vouchers.

" . . . According to the statements submitted by the auditor of the company, a sinking fund payment of $300,000 per annum, payable annually, and applied to the purchase of 5 per cent bonds to be kept alive for the purpose of augmenting the sinking fund payments by annual interest accretions would, if invested in bonds at 105 per cent, retire $30,000,000 face value of bonds in thirty-eight years, and $55,000,000 of bonds in fifty years, and would be still more adequate in the event of the redemption or retirement of the bonds being made on the basis of 105 per cent, and of course if applied to the purchase of bonds at less than either of the two figures named would to that extent accelerate the ultimate retirement of the entire bond issue.

" . . . To determine the exact replacement value of this equipment at the present time would be a long and tedious operation, which it was unnecessary to go into, inasmuch as the security offered for the protection of the proposed issue of bonds outside of and over and above the value of the equipment is ample. . . ."

" . . . The company has, however, acquiesced in the suggestion that the terms of the mortgage be so amended as to include in the mortgaged premises all property now owned or hereafter acquired by the company which shall constitute a part of the equipment as the same is defined in the leases of the subway, thereby materially strengthening and improving the security. . . . Nor are we called upon to say more than that the net income will in my opinion be much more than ample to meet the service of the notes and bonds to issue which at the present time the petitioner asks leave, without reference to the dividends on the stock."

New York City Railway Companies to Report on Car Equipment.

The Public Service Commission of the First District, state of New York, has adopted a resolution requiring the railroads to file with the secretary of the commission before May 10 a full and complete statement of the number and kind of cars operated, together with the kind of trucks used, the weight of the car when loaded, the weight overall, the style of fender, style of guard, style of brake, and the names of the manufacturers of the same. In moving the adoption of this resolution Commissioner Maltbie said:

"In the six months ended February 1, 1908, the street railways of Greater New York killed 299 persons and seriously injured 944. The total number of accidents due to collisions of street cars was 1,196, and the number of vehicles and persons struck by cars was 7,059. At this rate in an entire year about 600 persons will be killed and 2,000 seriously injured. The number of accidents due to collisions will approximate 2,400 and the number of persons and vehicles struck 14,000. From the standpoint of humanity this is a serious condition and ought not to be allowed to continue, if there is any way to prevent it.

"There is another phase of the subject. For the year ended June 30, 1907, the street railways of New York city paid out for injuries and damages, due to accidents, over $2,500,000. Over one-half of this sum was paid by the Manhattan companies and one-third by the Brooklyn companies. Anything, therefore, which will reduce the number of accidents will not only be a blessing to humanity, but will result in a saving financially to the companies.

"It is probably true that even with the best devices that can be adopted and with the greatest of care, it will not be possible to prevent accidents entirely, many of which will be serious and even fatal. But until the subject has been thoroughly investigated and every suggested remedy fully considered, our duty will not have been done, and it seems probable that the number of accidents can be very greatly reduced."

The Murnau-Oberammergau Single-Phase Railway.

In the issue of the ELECTRICAL REVIEW for April 4, in the article by Cyril J. Hopkins, entitled "Murnau-Oberammergau Single-Phase Railway," several unfortunate errors occurred. On page 530, third column, twenty-sixth line, the word "feet" should be read instead of "inches." On the same page, at the foot of the second column, the expression (18×1.47) should read $(18 \times 1.47)^2$. On page 534, in the table "Segregation of Percentage, Fixed Charges," the heading over the third column should read "Transmission and Trolley System. Bonding," instead of "Transportation and Trolley System. Bonding." In the same table, the third note should read "$\frac{5\%}{20} \times \frac{3.358}{5} = 0.17\%$." On the same page, in the table "Annual Performance of Equipment," the total for ton-miles should read "3,300,000." At the foot of second column, in "Summary-Chargeable to Passenger Service," the cost per ton-mile and cost per seat-mile should be, respectively, "0.74 cent" and "0.50 cent."

Copper production in the United States, Mexico and Canada for the month of March is estimated at 79,105,704 pounds, being an increase of 14,068,954 pounds over the output reported for February. The figures for March, 1907, were 102,495,230 pounds. Returns for the first three months of this year are 210,042,454 pounds, compared with 272,718,533 pounds for the first three months of last year.—*Copper Gossip.*

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

The Corrosion of Iron and Steel.

The recent discussion of the primary cause of the corrosion of iron and steel has suggested to F. Clowes the explanation of a phenomenon which he observed some years ago. According to Whitney, the rusting of iron in contact with water is started by an actual escape into the liquid of iron in the form of positively charged ions, and he states that he has succeeded in detecting iron by chemical tests in water which contained only a trace of electrolyte and was free from oxygen and carbon dioxide after the water had been in contact with iron. Some years ago the author went to considerable trouble to bring a surface of metallic lead free from oxide into contact with water free from dissolved gases, with the expectation that if these conditions were fully complied with, no lead would pass into the solution. In the course of the investigation the precautions which were taken to secure the conditions specified gradually became more stringent, and the amount of lead passing into solution was correspondingly reduced, but when the utmost possible care had been taken, lead, in very minute proportion, was still detectable in the water by chemical tests. The proportion of lead was found to be constant even when the contact of water with lead had been brought about in repeated experiments with some variations in detail. The impression produced by these results was that undoubtedly lead in the metallic state must have passed into the water, an action apparently similar to that which Whitney believes takes place with iron.—*Abstracted from Nature (London), April* 16.

San Francisco, Vallejo & Napa Valley Railroad.

Some information regarding the latest additions to the equipment of the single-phase railway running between Vallejo and Napa, in California, is here given by W. F. Lamme. The power-house for this railroad contains two motor-generators driven by power from the California Gas and Electric Corporation system. These were originally 400-kilowatt, 6,600-volt, two-phase, twenty-five-cycle units, delivering single-phase current to each of two insulated sections of the system. For feeding the trolley, five 200-kilowatt, 6,600 to 750-volt transformers are employed. There are three four-motor equipments, each motor being rated at 100 horse-power, and two four-motor equipments, the motors being rated at seventy-five horse-power. When first installed the trolley voltage was 750, but later it was raised to 3,300, the gear ratio of the motors was changed, the induction regulators at first employed were displaced by the unit-switch system and the generators were rewound to deliver 6,600 volts, single-phase, instead of two-phase at the same potential. The reason for this was the unbalancing of the generators due to the unequal traffic on the two sections of the road, which made it impossible to regulate the potential. Recent tests on this road, made on five new equipments, showed that with an average taken over 4,500 miles in regular service, the power consumption was eighty-nine watt-hours per ton-mile, and the line losses approximately ten per cent, so that the watt-hours per ton-mile at the switchboard were about ninety-eight. The power factor varies considerably from thirty to ninety-five per cent, being lowest at the start and rising rapidly with an increase in speed.—*Abstracted from the Journal of Electricity, Power and Gas (San Francisco), April* 18.

A Gasolene Electric Automobile.

An interesting gasolene-electric system of propulsion has been brought out by the Mercedes Company, of London. In this a generator of special design is driven directly by the gasolene engine and power is supplied from this to two series motors brought into the rear wheels. The armature of the generator rotates about an internal field, the former being built up of a slotted core carried on a spider. This core has a cone-shaped internal opening within which is a stationary field magnet, the pole-faces of which are also coned. The field magnet is mounted on a sleeve sliding on a fixed shaft on which a coarse thread has been cut. The object of this is to give control to the voltage of the machine, for by shifting the field magnet in or out, the length of the air-gap is correspondingly varied, thus raising or lowering the potential and at the same time shifting the field with respect to the brushes so as to maintain the latter in the proper position for commutating. The commutator is of the radial type. This arrangement, it is said, maintains the output of the generator constant irrespective of the torque developed by the motors. The motors resemble somewhat the generator, but the field magnet is fixed. It is internal to the armature, and the housing of the latter forms the hub of the wheel from which the spokes project. The commutator is radial and the brushes and field are carried on a fixed axle. By taking off the outer end-casing, one entire side of the motor and the commutator is exposed. The motors are wound as series machines and are operated in series and parallel. There are four forward speeds and one for reversing. An omnibus equipped with this system has been running in London for some time, with, it is said, good results. There is no automatic governor, the speed of the engine and the position of the generator field being under control of the driver.—*Abstracted from the Electrician (London), April* 17.

Application of Electric Power in the Production of Pig Iron.

A discussion of the use of electric power to assist in the operation of blast furnaces is given here by S. P. Bowen, the manager of the Tees Bridge Iron Works, Stockton-on-Tees, England. First taking up the question, the works engineer is confronted with the problem of deciding whether, in case he wishes to install the electric system, he shall produce his own power or purchase it. Where blast furnaces are directly connected with the coke ovens and steel works, the conditions are ideal for the adoption of a large power plant driven by the waste heat or by gas engines using the furnace gases, or by exhaust steam turbines using the steam from blowing engines. But in blast-furnace plants where no steel works or coke ovens exist, or where there is some question about the saving to be secured through the use of electric power, it would probably be advisable in the first case to purchase the power from a local electric company. Where steel works are operated at the blast furnaces, large blowing engines are required, which may be driven

by gas, and the gas plant will have sufficient spare gas for driving the electric generating plant. In smaller plants the exhaust steam turbine arrangement seems to be the more suitable, provided there is sufficient exhaust steam from existing engines to drive the turbines. There is, as a rule, an ample supply of exhaust steam quite sufficient to produce all the power required for operating the plant, the average power supply on this system amounting to about 500 kilowatt-hours for each 100 tons of iron made in twenty-four hours. There are many places in the iron-making process where the application of electricity has been, and can be, most economically adopted. This is particularly true regarding the methods of handling supplies and materials. In charging the blast furnaces, the ease with which the electrically driven hoists may be automatically controlled has been of much value. The author believes that the alternating-current system is, in general, more suitable for iron works than the direct-current, as the induction motor is the more serviceable machine, even under the worst conditions. This, of course, necessitates that variable-speed slip-ring motors be adopted.—*Abstracted from the Electrical Magazine (London), April 15.*

A New Metallic-Filament Lamp.

A brief description is given here of the new metallic-filament lamp which is to be brought out by the Bryant Trading Syndicate, Limited, of Highbury, London. The filament is made of an alloy of tungsten and some other metals, and burns with an efficiency of from 0.8 to 1.5 watts per candle, according to the life and candle-power of the lamp. For example, the 115-volt, twenty-candle-power lamp burns at 0.9 watt per Hefner candle and has a life of over 1,000 hours. This same lamp may be run on a 100-volt circuit when, the maker says, it would give ten candle-power with an efficiency of 1.5 watts per candle. A thirty-four candle-power, 200-volt lamp is also to be put out, as well as a seventeen-candle-power, 100-volt lamp. The 200-volt lamp is to consist of six filaments arranged in series, or of nine filaments arranged in the same way. In the latter case each double filament will be two and three-eighths inches long. The 100-volt lamp has four or five filaments in series. These filaments are cemented to the supporting irons at the top and are supported at the bottom by means of zig-zag springs which are attached to the filaments by means of a substance preventing them from sticking. The filament is said to be smooth and have the appearance of fine steel wire. The diameter is 0.0264 millimetre. No carbon paste is used in these lamps, which is said to prevent blackening of the bulbs. The lamps are for use in any position, though preferably with the filaments vertical. With this grouping of the filaments the distribution of light is uniform in the horizontal plane and in the vertical plane resembles two intersecting circles. Life tests of the lamp show a slight rise in candle-power during the first 100 hours, and then a very gradual decrease, due apparently to an increase in the resistance of the filament. The efficiency curves show a slight increase in the power of consumption per candle with time.—*Abstracted from Electrical Engineering (London), April 16.*

Electric Discharges Through Gases.

In closing the series of lectures on electric discharges through gases, delivered at the Royal Institution, London, England, Professor J. J. Thomson endeavored to explain the appearances seen in vacuum tubes when a current is passed. The cathode acts as the power station in these tubes. Here the conductivity of the gas is manufactured, and close to it is a very intense field. Under the action of this strong field the positive ions are dragged up to and collide with the cathode, their striking energy being very considerable. This bombardment causes the cathode to emit negative particles, which, repelled by the field, acquire a great velocity, and when this velocity reaches a certain limit, the particles are able to decompose any gaseous molecule they strike, producing fresh negative and positive particles. In the tube a double process is taking place. Within the negative glow the supply of negative particles is ample, and hence the current can be carried by these, even though moving at a relatively small velocity; and since this velocity is proportional to the field, the electric force, though very great close up to the cathode, is very small in the negative glow. If the particles proceeded through the rest of the tube without diminution in the number, a small field would suffice to take them up to the anode, and there might be no luminosity, a condition existing in the dark space. However, the negative particles collide with molecules and are diffused toward the walls of the tube, their number being thereby reduced. As a consequence, since the current must be the same at all cross-sections of the tube, those remaining must move more rapidly, and for this a stronger electric field is required. Consequently the electric force increases to higher and higher values until matters reach a stage at which the speed of the particles is sufficient to decompose the molecules struck, thus producing a fresh supply of negative particles, accompanied by luminosity. Immediately following this the electric force again is small, but again the particles are diffused toward the sides of the tube, requiring an increased velocity of those which remain, and a second decomposition of molecules with a second striae. According to this theory, any action tending to diffuse the negative particles toward the side of the tube would also cause an increase in the velocity of those not completely deflected and increase the tendency to produce striæ. This effect can be shown by bringing up a magnet to a tube through which non-luminous discharge is taking place. Immediately striæ appear and the tube becomes luminous. Turning then to the arc discharge, Dr. Thomson said that this had characteristics differing from discharges in tubes. In vacuum tubes the currents are usually small, and the principal fall of potential is at the cathode; in the arc discharge the current is relatively large, and the principal fall of potential is at the positive electrode. The arc is an instance of the discharge of electricity through a gas, which here plays only a very secondary part. The arc is a discharge of electricity from incandescent solids. A solid raised to a red heat emits negative electricity. This may be shown by passing an electric current through a solid so as to heat it. A discharge of negative particles will then take place. In the arc the necessary temperature for the discharge of the negative particles is maintained by a bombardment of positive particles from the anode, which must, therefore, be maintained at a high temperature; and if independent means are employed for keeping the cathode hot, any anode may be used. The cathode, however, must be some material which will withstand a high temperature without melting, since the number of positive particles emitted increases enormously with the temperature. Hence, for economical reasons, the cathode should not only be capable of standing a high temperature, but should be a poor conductor of heat, a condition fairly well fulfilled by carbon. The necessary temperature in the arc is partly due to combustion, but a complete explanation of the action going on there has not yet been given.—*Abstracted from Engineering (London), April 17.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Westinghouse Mill Motor.

The installations of electric motors for driving auxiliary machinery in steel mills have increased rapidly in the last few years, largely because their general characteristics make them particularly adaptable for this class of service; and owing to their ruggedness, mechanically and electrically, and the perfection of the control systems now developed, the electric drive gives results that are exceedingly satisfactory and reliable. The temperature in the mills is generally high, great quantities of metallic dust are present, the loads vary rapidly between wide limits, subjecting the motors to excessive mechanical and electrical strains, frequent reversals are required, and uninterrupted service with practically continuous operation is a necessity.

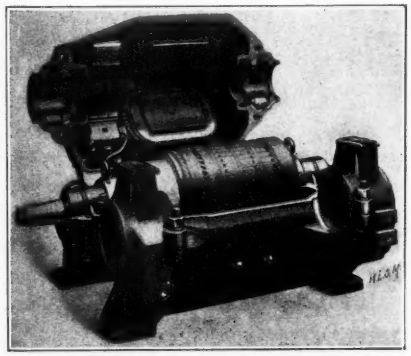
The mill type of direct-current motor, which has recently been put on the market by the Westinghouse Electric and Manufacturing Company to meet these conditions, has been carefully designed after a conference with a large number of prominent steel mill engineers with a full knowledge of all the electrical and mechanical requirements.

The illustration shows the motor opened for removal of the armature. As shown, the motor frame is divided horizontally and is hinged, allowing the upper half to be swung back and repairs made in the minimum amount of time. The heavy section of the frame insures rigidity and freedom from vibration. The frame is provided with handholes for inspection of the commutator and windings, but the covers fit tightly and the frame is dustproof. The bearing housing is extended beyond the bearing and a dustproof construction is secured by means of a steel washer and felt lining.

The dimensions of the shaft are exceptionally large with key-ways of liberal dimensions and the damages from bending and breaking are eliminated.

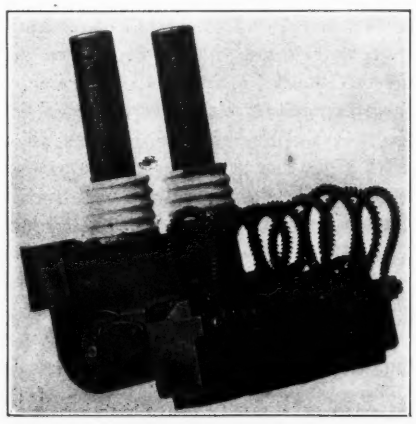
The shaft extensions on both ends are tapered and are of the same dimensions. Thus the bore of pinions and brake wheels or hubs conform to one standard, are easily fitted securely in place and can be removed rapidly.

The bearings are particularly satisfactory, because of the large amount of wearing surface, which insures a long life. The air-gap between the fields and the armature is large, which allows of considerable wear in the bearings before the revolving and stationary parts could rub. Special provisions have been made which prevent



WESTINGHOUSE MILL MOTOR, WITH UPPER FRAME RAISED.

oil from being drawn into the armature as well as from creeping along the shaft. The bearings are split and made interchangeable for either end of the motor. No dowel pins are used, as lugs cast with the bearings keep them from turning. An eye-



BRUSH-HOLDER AND BRUSHES OF MILL-TYPE MOTOR.

bolt on each bearing permits of ready handling of the armature.

The commutator and brushes are constructed with a low current density, and thus tend to reduce the heating to a minimum. The commutator is mounted on the same spider as the armature laminations, so that the shaft may be readily removed.

The carbon-holder is of very substantial design, and so constructed that by the removal of one holding bolt the entire holder as one piece can be removed from the motor. The insulation is thoroughly protected from moisture and mechanical injury.

The insulation used on the motors is incombustible throughout, and withstands high operating temperatures without deterioration. Asbestos, mica, porcelain or an insulating compound is used in all cases. The coils are treated with the compound and then baked at a temperature higher than any that will ever be met in normal service.

The armature coils are made of strap copper insulated with mica tape, hand wound. This form of coil can be easily repaired by the customer. The coils are held in place by hard fibre wedges and bands which are below the surface of the laminations. The rear end of the armature is provided with an end bell upon which the ends of the armature coils are securely banded.

Simplicity and accessibility of all parts for repair or removal are characteristic features of the motors, giving the advantage of quick changes and little loss of time. This improved design of motor has met with the approval of the steel mill engineers, and the results obtained by motors in service have been highly satisfactory.

Aluminum-Cell Lightning Arresters.

There has recently been placed on the market by the General Electric Company, Schenectady, N. Y., a form of electrolytic lightning arrester known as the aluminum-cell arrester for operating on alternating-current circuits. The arrester, as shown in Fig. 1, consists essentially of a series of concentric inverted cones placed one above the other with a vertical spacing of about three-sixteenths inch. The cones are insulated from one another except for the electrolyte, which partially fills them. Each cell then consists of two aluminum cones and the intervening electrolyte.

A sufficient number of cells placed in series forms a complete arrester, the electrical characteristics of which are the same as a single cell. The cones com-

plete with the electrolyte are immersed in a tank of oil, which affords the necessary insulation and great heat-absorbing capacity. These tanks are made of welded steel and are equipped with wooden covers and suitable porcelain bushings.

The efficacy of the cones as a lightning arrester depends upon a thin film which is formed upon the surface of the aluminum by a special process of manufacture. This film may be compared with the safety valve of a steam boiler which opens at a definite pressure and allows the steam to escape.

Each cell, two adjacent cones with intervening electrolyte, is designed to operate normally at 300 volts. If the potential rises to any value greater than 300 volts and less than 420 volts, the film allows the discharge to take place, but a thicker film is immediately formed and the current is again decreased to a small value. When the line potential becomes normal this extra thickness of film gradually dissolves, leaving the film in its normal condition.

At 420 volts (about forty per cent above normal voltage) the film opens and allows a free and heavy discharge to take place. This voltage represents the maximum critical film value per cell. The plate area of the cells is sufficient to allow a discharge of more than 1000 amperes at double normal potential, or 600 volts per cell. This represents a quantity of electricity many times greater than that usually liberated by an ordinary induced lightning stroke. Consequently it is not possible to get an excessive potential across the terminals of the arrester by such discharges.

The aluminum cell arrester is designed to be connected to the line through adjustable horn gaps. These gaps may be set so that the voltage will break across at any desired rise above the normal operating voltage. When the conditions warrant the gaps can be set so as to allow the arrester to discharge when the line voltage rises only about twenty-five per cent.

The horn gaps perform three important functions: First, they act as spark-gaps, as explained; second, they may be used as disconnecting switches, and third, for subjecting the arrester to normal voltage. It is recommended that current be sent through the arrester every day or two, so as to assure proper formation of the film on the aluminum cones. The horn gaps are so constructed that they can be easily short-circuited momentarily for accomplishing their purposes.

In the General Electric aluminum-cell arresters for alternating-current circuits the use of steel for the containing tank prevents liability of breaking during transportation, installation or operation.

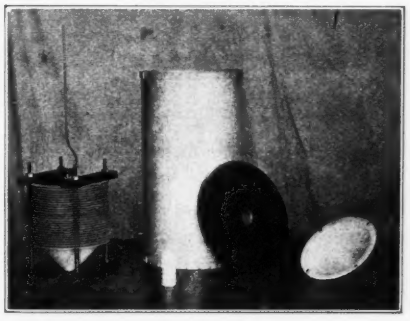
Another important feature in the mechanical construction of these arresters is that the aluminum cones are supported by their rim at four points, thus making a sturdy construction and eliminating any liability of the adjacent cones short-circuiting against each other.

The cone shape or pointed construction of the aluminum has a very decided advantage in preventing explosive or corrosive action of the arrester and prevents local heating and short life.

Some of the advantages of this type of arrester, from a protective standpoint of view, are as follows:

(1) They are designed to discharge at a comparatively small rise of voltage.

(2) The arrester will discharge the heaviest induced stroke without allowing



EXPLODED VIEW OF ONE LEG OF 12,500-VOLT ALUMINUM LIGHTNING ARRESTER.

an abnormal rise of voltage in the system.

(3) The large amount of oil used for heat absorbing and radiating capacity enables the arrester to discharge continuously for one-half hour. This is particularly desirable in case of a grounded phase, since the cause of the ground can often be located in a half hour's time, or necessary switching be done so as to transfer to another set of busses.

(4) An inherent feature of General Electric aluminum cell arresters with a properly formed film is the fact that no dynamic current will flow as a result of the discharge.

Approve Westinghouse Plan.

The merchandise creditors' plan for the rehabilitation of the Westinghouse Electric & Manufacturing Company has been approved by the representatives of claims aggregating $3,500,000 out of a total of $4,250,000 of merchandise debt, according to a statement issued yesterday by the merchandise creditors' committee. One of the features of the merchandise creditors' plan is an offer to take stock in the Westinghouse Company at par in payment of their claims to an amount aggregating $4,000,000. The plan provides that $10,000,000 of new assenting stock must be subscribed for. With the $4,000,000 to be taken by creditors, it will be necessary for stockholders to provide the remaining $6,000,000.

In a circular letter to stockholders sent out recently by George Westinghouse, the stockholders are urged to subscribe promptly to prevent a sale of the property. The circular says in part:

"Your affairs have been officially administered by the receivers, and since their appointment the direct and contingent liabilities of the company with reference to its Canadian and European interests have been reduced by $1,750,000. They have also converted into cash a large amount of surplus materials, raw, in process and finished, which were on hand on October 23, 1907, thus very materially strengthening and improving the general situation. Your interest in the company as a stockholder is nevertheless in serious jeopardy owing to the unfortunate financial events of last October, which necessitated the appointment of receivers on the 23d of that month to administer your affairs and to preserve your property until provision could be made by the united action of the creditors and stockholders of the company to adjust the debt and provide ample new working capital to carry on your business on a cash basis and to an extent commensurate with the facilities already provided to meet the increasing demands in normal times.

"Your creditors, through a committee appointed to represent them, have been very indulgent and have already given a total of seven months (until June 1) to permit the several interests involved to perfect some plan which would adjust the debts of the company and also conserve your interests as stockholders. Will not each stockholder assist the efforts being made by the readjustment committee, the merchandise creditors' committee, numerous stockholders, and any others interested in the situation, to perpetuate a business of such great importance in the industrial world and thereby protect his own interests? If you do not subscribe you in effect vote for a sale of the property by the creditors and thus the elimination of all stock interests.

"Concerning the future management of the company I may add that I consider essential the election of a board of directors representative of the several interests whose character and experience will insure a safe management of finances and who will devote enough time to your business to become so acquainted with its requirements that they can intelligently direct its affairs."

The Sewage Pumping Stations at Dayton, Ohio.

The city of Dayton, Ohio, lies in a valley surrounded by hills whose slopes drain very rapidly. At this point, several streams unite to form the Great Miami River. This stream in summer is of insignificant proportions, but in late winter and early spring after a sudden rain or melting snow, it rises in a few hours to the proportions of a great river. To protect the city from inundation, levees are maintained, but a rise in the river cuts off the sewers and it is necessary to close the

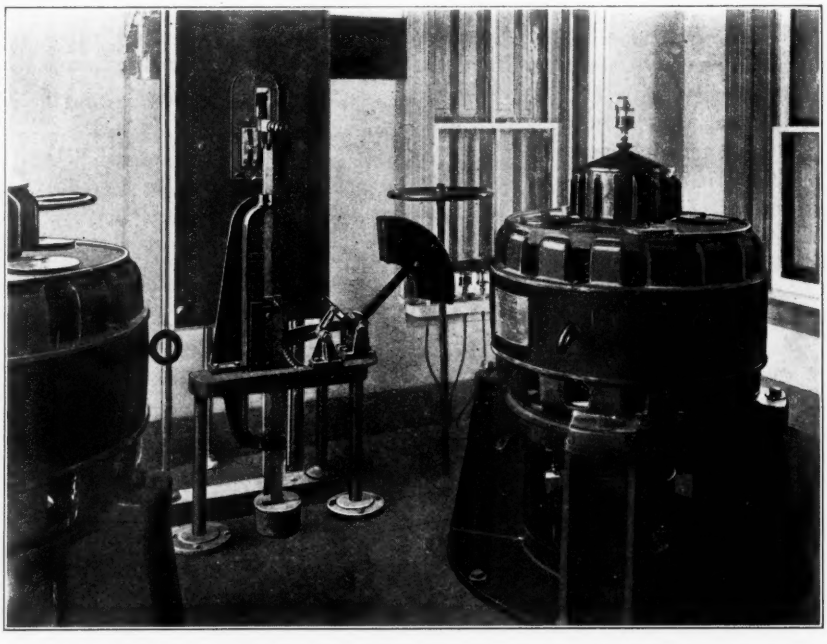
One of the Three 4,500-Gallon Centrifugal Pumps in the Longworth Street Plant.

gates at the outfalls to prevent the river backing up into the streets and houses. At such times it is necessary to raise the sewage and discharge above the flood level. After careful investigation and some costly and unfortunate experiments with steam pumps and pneumatic ejectors, which either required too much attention or were too expensive or uncertain in operation, the city of Dayton decided to install automatic electric pumps and awarded the contracts to the Dayton Hydraulic Machinery Company, builder of the well-known "Brooks" and "Dayton" centrifugal pumps.

When electric motors were decided upon as the driving power, central station power was also accepted as the only satisfactory generating source, since power can be obtained on a moment's notice at any time, night or day. Consequently, there is the entire elimination of steam boiler and engine troubles, as these are all cared for by the central station, which is running at all times, whether the water in the river is high or low. Were any other power adopted for the pumps, the maintenance and operating charges would be increased.

Lehman Street Pumping Plant.

Three stations have so far been constructed in various sections of the city. The first is equipped with two vertical 2,500-gallon "Brooks" submerged centrifugals, geared to twenty horse-power, horizontal, "CCL," three-phase, sixty-cycle Westinghouse motors. The motors are started and stopped by standard oil-switch compensators which are operated by hydraulic pistons controlled by float switches designed and built by the Dayton Hydraulic Machinery Company under their patents. The lift is variable, averaging about twenty feet. The discharge is through a check valve at a point below extreme high-water. The operation of these pumps is entirely automatic, it being only necessary to inspect them occasionally and keep the oil receptacles filled. Upon



Interior of Lehman Street Pumping Plant, Showing Auto-Starter and Forty-Horse-Power Motors.

notice of a rise in the river, the gates are closed and the current turned on, after which the pumps cut in and cut out automatically with the rise or fall of the sewage in the pits.

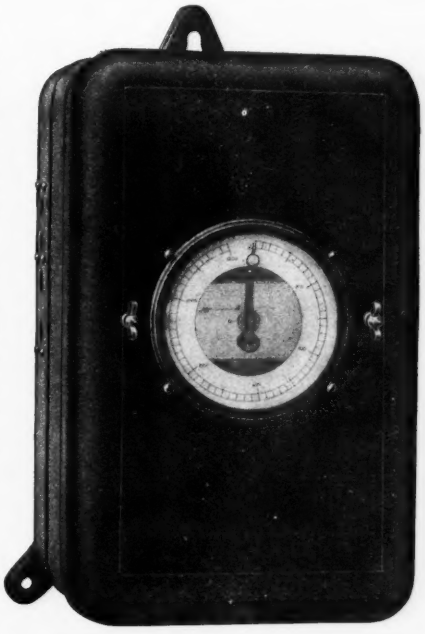
The second station, at Longworth street, has three units and the third station, at Lehman street, two, each consisting of a double-suction, vertical, submerged 4,500-gallon Brooks centrifugal, direct-connected to a forty-horse-power, vertical-type "CCL" three-phase, sixty-cycle, 2,800-volt Westinghouse motor.

The starting apparatus at these last two stations consists of floats which operate the valves on a hydraulic piston, using water under pressure from the city mains. On starting, this piston raises the lever on a Westinghouse auto-starter to the starting position, at the same time rotating an arm carrying a heavy counter-weight which, by the time the motors have picked up speed, falls, and, by means of a pawl, drops the lever to the running position. On stopping, the reverse motion given the counter-weights, moves the lift to the cut-out position. The operation of this apparatus is extremely satisfactory and the motors cut in and cut out automatically with great regularity and smoothness. During a heavy rain when the river was quite high, one pump was sufficient to take care of the flow in the sewers at the Lehman street station when running three minutes out of each ten, being idle the remaining seven minutes.

A New Maximum-Watt-Demand Indicator.

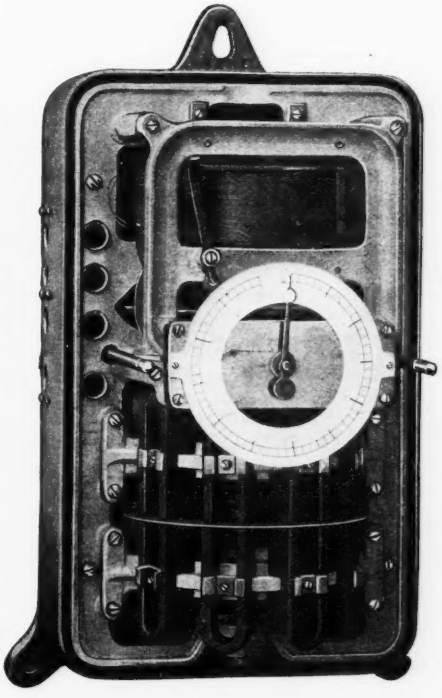
In many cases it is necessary to know the actual maximum watt consumption on alternating-current circuits, especially in motor installations. To meet the demand for this type of instrument the General Electric Company, Schenectady, N. Y., has placed on the market an indicator designed to operate correctly within commercial limits on two or three-phase circuits, with balanced or unbalanced, inductive or non-inductive loads. By proper connections it may also be used on single-phase circuits.

This device is a modification of the "D-3" polyphase wattmeter, with both electrical elements acting on the top disc and a strong damping system acting upon the lower disc to provide the necessary time lag. In place of the usual register there is provided a single graduated dial and two pointers. One of these is driven by the moving element through a train of gears and indicates at any instant the energy passing through the device. The other pointer is driven by the first and remains at the maximum position reached



NEW MAXIMUM-WATT-DEMAND INDICATOR.

by it, being held in this position by a ratchet. The final position reached by this



MAXIMUM-WATT-DEMAND INDICATOR, WITH COVER REMOVED.

second pointer indicates the maximum energy taken from the circuit. A thumb-nut is used to set the maximum-demand pointer back to zero, and it may be sealed to prevent tampering by unauthorized persons.

The length of time required for the pointer to reach its maximum position, or the time lag, will depend on the torque of the motor elements and the strength of the damping magnets, and may be varied from one minute to thirty minutes. The indicator is rated by defining the time lag at ninety per cent of full scale, since between ninety and 100 per cent the movement is very slow compared with the speed from zero to ninety per cent.

The polyphase demand indicators are made self-contained in capacities from twenty-five to 150 amperes, 220 to 650 volts. Above these capacities current and potential transformers must be used. The indicators are furnished with an all-metal cover finished in black japan.

The End of the Lipsey Case.

Ralph Lipsey, who was indicted by the Grand Jury in January, 1906, charged with having received 2,000 Perkins sockets which had been stolen from the Electric Appliance Company, of Chicago, Ill., and subsequently disposed of by Lipsey, and who was convicted in the February term of 1906, has been finally returned to the Joliet (Ill.) penitentiary after being released several times through the efforts of his attorneys. On April 23 the Supreme Court handed down a decision declaring that it would not permit its decisions to be reviewed by an inferior court under the guise of habeas corpus proceedings, a condition which had allowed Lipsey to be brought to court several times. Lipsey was ordered forthwith returned to the penitentiary to serve an indeterminate term. By this decision of the Supreme Court the uneffective criminal administration of Illinois, which heretofore permitted an endless chain of trials and retrials, has come to a proper ending, and no longer can habeas corpus be invoked and successfully worked to release men from the penitentiary who have been placed there by a mandate of the Supreme Court.

James J. Barbour, state attorney, handled the case against Lipsey, and Frederic P. Vose, general counsel for the National Electrical Trades Association, is given credit for running down and unearthing Lipsey's fence, which was a menace to the electrical trade of Chicago and elsewhere. It was on Mr. Vose's testimony, very largely, that Lipsey was convicted.

Current Electrical News

DOMESTIC AND EXPORT.

IDAHO WATER-POWER DEVELOPMENT—Work has been commenced on a power plant to be located within the city limits of Lewiston, Ida., and to utilize the water power of the Clearwater River. More than 50,000 horse-power will eventually be developed. The North Coast Power Company, represented by Engineer Frank McKean and George W. Tannahill, is the concern undertaking the work, and it is understood that the power so developed is to be used for an extensive system of interurban lines connecting Lewiston and vicinity with Clarkston, Asotin, Anatone, Cloverland and Pomeroy, and extending into the Craig Mountain timber belt and to the cement, lime and coal deposits on the Snake River above Lewiston.

TO COMPLETE CHICAGO & MILWAUKEE ELECTRIC LINE—Judge Tarrant, in the Circuit Court, at Milwaukee, Wis., on April 24, signed an order directing the Fidelity Trust Company, as receiver of the Chicago & Milwaukee Electric Railway Company, to issue certificates of indebtedness for the benefit and protection of the property of the railway company. The certificates are issued in order that the work of completing the Frost road into Milwaukee may be completed without delay. The order, which was signed in the case of the Columbia Construction Company against the Chicago & Milwaukee Electric Company, directs the trust company to issue certificates to an amount necessary to meet building requirements. The Columbia Construction Company agrees to purchase the certificates to pay for real estate purchased or condemned for right of way and general construction work, the certificates to bear interest at six per cent.

NEW TRACTION COMPANY IN DETROIT OFFERS EXTENSIVE CONCESSIONS—The Detroit Traction Company which, through William E. Baubie, is asking for a thirty-year three-cent-fare franchise from Detroit, Mich., has offered to do all the paving and repairing of paving between its tracks should it get a franchise, in addition to the other things offered. Mr. Baubie has asked the council to submit the franchise to a vote of the people at a special election. Mr. Baubie is quoted as follows: "The ordinance asks for a thirty-year franchise, but provides that should the city decide to operate its own systems the municipality can take over the ordinance and all property of the company upon a six-months' notice. A bond for $50,000 will be filed immediately if required." The promise of the company will be, Mr. Baubie says, not to bond for more than $55,000 a mile, and he expects that the stock of the company will not run more than $25,000 a mile.

HOLDERS OF DEBENTURE BONDS BLOCK FINANCING PLAN OF PACIFIC GAS AND ELECTRIC COMPANY—Guggenheimer, Untermyer & Marshall, acting for the Industrial and General Trust Company, Limited, and other plaintiffs, including Baron Ashton, has obtained from Judge Dowling in the Supreme Court, at New York, an injunction restraining the Pacific Gas and Electric Company, the Trust Company of America, Frank A. Vanderlip and others from carrying out the plan providing for the exchange of the debentures of the Pacific Gas and Electric Company for mortgage bonds. The court also restrains the Trust Company of America from exchanging the deposited debentures for the mortgage bonds. The Pacific Gas and Electric Company is a San Francisco company controlling gas and electric franchises in San Francisco and adjoining cities. It is capitalized at $30,000,000 and has bonds outstanding of about $10,000,000. It is learned that the company planned to create a mortgage which is being objected to by holders of debenture bonds. N. W. Halsey is chairman of the company.

ELECTRIC SYSTEM OF 283 MILES PLANNED—Simultaneously with the increase in the capital stock of the Oregon Electric Company from $2,000,000 to $10,000,000 has begun actual construction on the first of the 283 miles of extensions, branches and laterals to the Portland and Salem Electric line which was placed in operation within the last few weeks. The roads mapped out are: Portland to Tillamook, *via* Hillsboro; Portland to Eugene, *via* Corvallis; Salem to Mill City, Salem to Dallas, Salem to Albany and Albany to Cascadia. Supplementary articles of incorporation, necessary to the increase have been filed in the office of the county clerk of Multnomah County, Oregon. Guy W. Talbot, Edward Cookingham, James B. Kerr and George F. Nevins are the nominal incorporators signing the new articles. The road is backed by Moffat & White, bankers, of New York city, and Charles M. Pratt, of New York, is president. Work has been begun on the Portland-Hillsboro-Tillamook line. When completed, the system of electric roads of this company terminating in Portland will exceed 330 miles.

CHICAGO-NEW YORK ELECTRIC LINE—At a meeting of the stockholders of the Chicago & New York Electric Air Line Company, at Portland, Me., the management was authorized to reduce the par value of the stock from $100 to $25, the stockholders of record to receive four of the new shares for one of the old, and to issue $680,000 par of preferred seven-per-cent cumulative stock. On suggestion of President A. C. Miller, of Illinois, a committee consisting of George C. Goodrum, of Fall River, Mass.; Charles Michaels, of Laporte, Ind., and C. Fairfield, of Minneapolis, Minn., was appointed to investigate three receivership suits which it was said had been brought against the company, but had later been vacated by the court. There was represented at the meeting 201,000 of the 250,000 shares of stock outstanding. President Miller said that ten miles of the road was in operation and that by fall thirty-six miles, between Laporte and Gary, Ind., would be in operation. The preferred stock issue was to provide for completing this section. The company was incorporated in Maine in 1905 with an authorized capital of $25,000,000, all common stock.

NEW MANUFACTURING COMPANIES.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Electric Equipment Company, with a capital of $20,000.

BOSTON, MASS.—The Automatic Electric Signal Company has been incorporated with a capital of $100,000. The officers are: President, S. A. Corbett, Boston; treasurer, F. L. Hall, Winthrop.

DOVER, DEL.—The Protectus Electrical Manufacturing Company, of Pittsburg, Pa., has been incorporated with a capital of $125,000. The incorporators are: E. L. Kern, J. K. Neagley, N. F. Bicking, Pittsburg.

ALBANY, N. Y.—A. W. Nugent, Incorporated, of Yonkers, has been chartered by the state department, to deal in electrical apparatus, etc. The capital stock is $5,000, and the directors are as follows: A. B. Gronbeck, F. A. Nugent and Elizabeth Nugent, of Yonkers.

RALEIGH, N. C.—A charter has been granted Tucker & Laxton, Incorporated, of Charlotte, capitalized at $10,000, for manufacturing and dealing in appliances for electric light, gas and steam, especially apparatus for street cars. The incorporators are: F. S. Tucker and A. P. and F. M. Laxton.

PROVIDENCE, R. I.—The United Electric Signal Company has been incorporated at the office of the secretary of state. The articles of association name Arthur M. Allen, Abbott Phillips and Rush Sturges as the incorporators. The company will be located in Providence and will manufacture and deal in electric signals and appliances of a similar nature. The capital stock is placed at $200,000.

EDUCATIONAL NOTE.

THE HEBREW TECHNICAL INSTITUTE—The commencement exercises of the graduating class of the Hebrew Technical Institute will be held on Wednesday evening, May 13, in the large hall of Cooper Union, New York city. There will also be an exhibition of the work of the past year at the institute, 36 Stuyvesant street, New York city, on Monday evening, May 11, from eight to ten o'clock; Tuesday afternoon, May 12, from three to five o'clock, and Tuesday evening, May 12, from eight to ten o'clock. Morris Loeb is president and Edgar S. Barney principal of the institute.

ELECTRIC RAILWAYS.

LINCOLN, NEB.—The Citizens' Railway Company has secured permission of the county commissioners to build to University Place and Havelock. Later it is planned to build a line to Ashland.

SPRINGFIELD, ILL.—The Illinois Traction System will spend $5,000 remodeling the old car barns in Springfield to fit them for the use of the company. The work will include enlarging the present buildings and arranging a passenger station.

MARSHALL, ILL.—Surveyors who are laying out the route of the new interurban line between Charleston and Terre Haute *via* Westfield and Marshall have practically completed the work. As soon as the survey is completed construction work will be begun.

BOULDER, COL.—The Denver & Interurban road expects to reach Boulder with its first cars about May 15. It is estimated it will take an hour and twenty minutes to run from Boulder to the tramway loop in Denver. Hourly service will be provided between the two places.

MOROCCO, IND.—The Chicago & Southern Traction Company's route has been surveyed from Crete to Momence, and from the latter point it is proposed to extend the line to Kankakee. There is a rumor of a connecting line between Momence and Lafayette and that a survey for this line will be made soon.

DENVER, COL.—The Intermountain Railroad, formerly the Denver, Lakewood & Golden, which is engaged in electrifying its line from Denver to Golden, expects to have the new service in operation within thirty days. The company is figuring on making a forty-minute schedule between Denver and Golden.

HORNELL, N. Y.—Surveyors are at work laying out the Hornell branch of the Rochester, Corning & Elmira Traction Company. A survey was made last spring but the company desires to make some changes. An application will be filed with the Public Service Commission asking for a certificate of necessity and work will be started when it is granted.

MINNEAPOLIS, MINN.—President M. M. Savage and the board of directors of the Dan Patch Air Line have awarded and signed contracts for all the grading between Savage and Northfield, a distance of nearly thirty miles. The work will cost $150,000. It must be completed within ninety days. The contractor is H. A. Whittier, of Northfield.

WATSONVILLE, CAL.—The committee which has had under way the rehabilitation of the electric line from Watsonville to Port Watsonville announces that it has received an option from the bondholders of the Watsonville Transportation Company agreeing to sell the entire holdings of the company for $50,000 in twenty-payment bonds of $2,500 each.

HOOSICK FALLS, N. Y.—The trolley road formerly known as the Bennington & Hoosick Valley Railway, extending from Bennington to Hoosick Falls, a distance of sixteen miles, will be placed in good physical condition during the coming summer by the present owner, the New York, New Haven & Hartford Railroad. It is understood $100,000 will be expended in repairs and improvements on the line.

ST. LOUIS, MO.—The Hillsboro, Kimswick & Northern Railway Company, which is to extend to Crystal City, thirty miles south of St. Louis, has applied for a franchise in St. Louis, so as to connect with the Broadway line at Poepping street. The company wants to enter the city at Ivory avenue and the River des Peres, and lay its tracks over Ivory avenue and Poepping street to Broadway. A like bill was presented to the municipal assembly two years ago.

BOWLING GREEN, OHIO—By a deal between the board of trade and E. H. McKnight, manager of the Lake Erie, Bowling Green & Napoleon Railway Company, the extension of the electric line to Tontogany is assured. A through route will be established from Lima through Deshler, Bowling Green, Woodville to Fremont and Port Clinton. The board of trade has taken $10,000 in bonds of the road, and has agreed to act as trustee for another $10,000 bond issue.

BROOKLYN, N. Y.—The Brooklyn Union Elevated Railroad Company has made an application to the Public Service Commission for the right to the exclusive use of two of the tracks provided for elevated railroads upon and across the Manhattan Bridge and approaches when constructed across the East River, together with necessary connections, terminals, switches, sidings, turnouts, wires and equipment for the operation of its elevated railroad cars from the borough of Brooklyn over and across the bridge and approaches thereto.

BILLINGS, MONT.—According to articles of incorporation of the Stillwater Power and Railway Company, filed here, an electric railroad will be constructed from Billings to Cooke City by way of Columbus, and work on the line will soon begin. There will be branches to Yellowstone, Sweet Grass, Carbon and Park counties. The capital stock of the company is $3,000,000, and among the seven directors are: Willard Bennett, of Helena; George H. Savage, W. E. Dufrésee and E. E. Congdon, of Butte. The line will open a rich mining region.

TOLEDO, OHIO—A through electric line between Detroit, Toledo and Indianapolis is assured, if negotiations now under way are successful. Representatives of an Indiana traction syndicate have been over the line of the Toledo & Indiana Railway, which is in the hands of a receiver. This syndicate is figuring on taking over the property when it is sold. This property is the link that is needed to complete the Detroit, Toledo and Indianapolis line, and if acquired it will be necessary only to build a stretch of new track about twenty-five miles long to connect the two links.

WESTON, ORE.—The city council has granted a franchise for an electric railway on Water street through the city for a period of twenty-five years to E. S. Isaacs, of Walla Walla. The road is to be completed in eighteen months and regular service must be inaugurated in two years. The company is required to erect and maintain a bridge over Pine creek. The line contemplated seems to be an extension of the proposed line leaving Walla Walla to the eastward of the cemetery, swinging westward to Hudson Bay, thence up Pine Creek to Weston and on to Pendleton.

LAKEWOOD, N. J.—It is stated that the proposed trolley road between Lakewood and Point Pleasant will be built this year. More than $50,000 has been expended on right of way and construction, and only $100,000 more is needed. The cars will be run under a thirty-minute headway from Lakewood to the sea front at Point Pleasant. At the latter place it is proposed to build a $10,000 casino. It is proposed to complete and have the road in operation by July 1, 1908. It is also proposed to have the road connect with the Atlantic Coast line by the extension of the latter from Sea Girt to Point Pleasant.

CALUMET, MICH.—Stone & Webster, of Boston, general managers of the Houghton County Electric Light Company, have mapped out a line of improvements on their properties which will result in the expenditure of $1,000,000 this summer. Among the more important work to be done will be the extension of the street railway six miles to Mohawk, erection of a new substation at Laurium, rebuilding of the overhead system at Calumet, new transmission line from Calumet to Mohawk to provide power for the mines, enlargement of car barns at Laurium and Hancock, and improvements to coal-handling apparatus at Hancock and Houghton.

SPARTANBURG, S. C.—The Electric Power and Manufacturing Company, a two-million-dollar concern, composed of Pittsburg capitalists, has purchased the Spartanburg Street Railway, Gas and Electric Company, and will take over the property within a short time. The acquisition of the street railway company by the Electric Power and Manufacturing Company means that extensive improvements will be made. The Electric Power and Manufacturing Company is chartered under the laws of South Carolina. The general offices of the company are located in this city. The company will be ready to furnish electrical power in Spartanburg within the next six weeks.

SPRINGFIELD, ILL.—Springfield men are the incorporators and first board of directors of the Alton, St. Louis & Cairo Railway Company, a license to incorporate which has been issued by the secretary of state. The principal office is to be at East St. Louis and the capital stock is nominally $100,000. It is proposed to con-

struct a railroad from Alton, through the counties of Madison and St. Clair, to East St. Louis, and from East St. Louis, through the counties of St. Clair, Monroe, Randolph, Jackson, Union and Alexander, to the city of Cairo, with a branch to Columbia, Waterloo and Mammoth Cave in Monroe County. The incorporators and first board of directors are: B. B. Renfrow, Dr. C. H. Walters, William L. Ensel, George M. Switzer and C. B. Meredith, all of Springfield. Dr. Walters says the railroad is being promoted by Colonel Thomas N. Chase, of St. Louis. The right of way from Alton to Cairo has been secured.

FREDERICK, MD.—The Washington, Frederick & Gettysburg Railway Company has purchased from the Monocacy Valley Railway Company the latter's line of railway, which will be made part of the purchasing company's line. The Monocacy Valley Railway runs from Catoctin Furnace to Thurmont, a distance of about five miles, and at Thurmont connects with the Western Maryland Railroad. The Washington, Frederick & Gettysburg line now runs from Frederick to Lewistown, about three miles from Catoctin Furnace. The executive committee, after the deal was made was instructed to proceed at once to build the connecting line. The price paid for the Monocacy Valley line was $35,000.

BELLEFONTAINE, OHIO—The Ohio Electric Railway Company has settled the differences existing between the company and the city. The old franchise is renewed for twenty-five years and the company gets an outlet for its Lima line, which has been completed from Lima to within three miles of Bellefontaine. Suits brought by the city against the company are dismissed and the company has paid $4,300 on a disputed paving assessment, donated ground to the city for a street and entered into a bond to improve another street by widening it. It is expected to have cars in operation on the new line from Bellefontaine to Lima within six weeks, thus completing the Schoepf syndicate's river-to-lake line.

CLEVELAND, OHIO—The city council, acting under advantages conveyed by the Schmidt bill, has passed an ordinance granting the Forest City Railway Company franchises in Woodland avenue, Kinsman and Buckeye roads, and Detroit, Madison and Lorain avenues and tributary streets for fifteen years. These replace Cleveland Electric grants held to have expired. The council also passed the ordinance granting the right to the Neutral Street Railway Company to build lines in Central and Quincy avenues. This measure was passed as a result of an agreement entered into between Mayor Johnson and F. H. Goff in the course of peace negotiations. It will not be contested if the street-railway fight should be renewed.

ROCHESTER, N. Y.—A special meeting of the stockholders of the Holland-American Construction Company has been called for May 11 for the purpose of voting on a proposition to dissolve the company. The company was organized for the purpose of building a trolley road in Holland, connecting Amsterdam, Zaandam, and Krommenie, with branch lines to Wik aan Zee, on the North, and Edam, on the Zuyder Zee. The company was capitalized at $1,000,000 and was incorporated on September 26, 1905. The directors of the company for the first year, and so far as known they are still in office, were J. George Kaelber, John F. Alden, John N. Beckley, Charles H. Palmer and George C. Buell, of this city; Joseph H. Lukach and Newcomb Carlton, of London, England; Walter D. Updegraff, of Pittsburg, and George C. Smith. The dissolution of the company is a result of the financial difficulties last fall of the Westinghouse companies in Pittsburg.

REDLANDS, CAL.—The organization of the Yucaipa & Oakglen Railroad has been effected. The company will construct at once an electric line from this city to a new colony established in the Yucaipa, seven miles distant. By fall the road will be completed to Oakglen, twenty-two miles from Redlands, and eventually will be extended to Beaumont and San Jacinto, to which points preliminary surveys have been completed. While it is denied that the road has any connection with any of the three transcontinental steam roads or the Huntington electric system, it is thought that Mr. Huntington is interested in it. The officers are: President, J. F. Neeland, of Los Angeles; vice-president, C. S. Chesnut, of Redlands; treasurer, M. N. Newman, of Los Angeles. These gentlemen with W. D. Larrabee, of Los Angeles, and A. P. Maginnis, of Los Angeles, form the board of directors. Maginnis is in charge of the Santa Fé icing plants and Neeland is president of the Pan-American Railroad in Mexico.

FORT DODGE, IOWA—A committee of business men from Emmetsburg, Iowa, met a special committee of business men and capitalists in this city, and plans were formulated for the construction of an interurban road sixty-five miles long from this city to Emmetsburg, to be known as the Spirit Lake, Emmetsburg & Fort Dodge Railway. A special election will be held in Fort Dodge for the purpose of voting a tax of $75,000 and a stock subscription of $25,000. A corresponding amount has been subscribed at Emmetsburg and a large amount of stock has already been placed with farmers, principally between this city and the northern terminal. Nearly all of the right of way has been donated by farmers. A New York construction company has submitted a proposition which will probably be accepted and actual work will be begun as soon as the weather permits. The construction of the line, which will connect with the Fort Dodge, Des Moines & Southern electric, will give a continuous route from Des Moines to Emmetsburg, a distance of 152 miles.

NEW PUBLICATIONS.

THE STRUCTURAL MATERIALS TESTING LABORATORIES AT ST. LOUIS, MO.—The Department of the Interior, United States Geological Survey, has published bulletin No. 329, devoted to the "Organization, Equipment and Operation of the Structural Materials Testing Laboratories at St. Louis, Mo.," by Richard L. Humphrey, with a preface by Joseph A. Holmes, in charge of the technologic branch.

"ACCIDENTS—THEIR CAUSES AND REMEDIES"—This is a very interesting treatise by Thomas D. West, on the development of care and faithfulness to aid the safeguarding of life and property, and is sold by the Competent Life Book Agency, of Sharpsville, Pa., for twenty-five cents. The work is dedicated to the American Anti-Accident Association and the American Museum of Safety Devices and Industrial Hygiene. Mr. West points out where, by a proper realization of fundamental rules and conditions, much can be done to eliminate and minimize the accidents which now occur in every walk of life.

"POCKET LIST OF RAILROAD OFFICIALS"—No. 54, for the second quarter of 1908, of the "Pocket List of Railroad Officials," has been issued by the Railway Equipment and Publication Company, 24 Park Place, New York city. This contains an alphabetical list of railroad officials, associations of railroad officers, headquarters of officials arranged by states, express and telegraph companies, an alphabetical list of railroads, a list of national and state railroad commissioners, a table showing miles of road operated, equipment, etc., a list of transportation companies and car lines, and representatives of railroad supply companies.

NEW INCORPORATIONS.

HELENA, MONT.—Water Users' Electric Company, of Sidney. $50,000. Incorporators: W. D. Kermis and others.

HARRISBURG, PA.—Patrons' Rural Telephone Company, Centre Hall, Centre County; $10,000. Farmers' Union Telephone Company, Catawissa; $5,000.

HOUSTON, TEX.—The Citizens' Electric Light and Power Company, of Gonzales. An amendment to its charter increasing its capital stock from $10,000 to $15,000.

AUGUSTA, ME.—Rangeley Light and Power Company, Farmington. For the purpose of generating and supplying gas and electricity for light, heat and power. $10,000 capital stock. Officers: President, Dwight D. Elliott, of Rangeley; treasurer, Harry A. Furbish, of Monmouth.

ALBANY, N. Y.—The Champlain & Sanford Railroad Company. $600,000. Organized to operate a steam or electric line, fifty-eight miles long, from Addison Junction to Sanford Hill, on the east shore of Lake Sanford, in Essex County. Directors: Charles M. Hyatt, Andrew Thompson, James M. Thompson, G. Hill, David Thompson, Lewis R. Parker and R. W. Jones, Sydney T. Jones and MacNaughton Miller, all of Albany.

PERSONAL MENTION.

MR. D. H. WALLBRIDGE has been made general manager of the Central & Eastern Colorado Power Companies. He will have charge of construction work.

MR. BURTON OSBORNE has resigned as director and secretary of the Home Telephone Company, of Camden, N. Y., and A. M. Farnsworth has succeeded him.

MR. R. W. BROWN, for the past year superintendent of the Adrian (Mich.) Street Railway Company, has been appointed superintendent of the Toledo & Western Railroad Company, of Toledo, Ohio.

MR. A. A. KNUDSON has removed his office to 50 Pine street, New York city, where he has increased facilities and an assembly of new and standard instruments which will enable him to carry on the work of electrolytic examinations, in which he is a specialist, to better advantage than formerly.

MR. HARRY B. IVERS, treasurer of the Bangor Railway and Electric Company, and assistant to the company's president, has been appointed general manager of the Lewiston, Augusta & Waterville Street Railway, Lewiston, Me. Mr. Ivers will resign as treasurer of the Bangor company, but will retain the position of assistant to the president.

DR. LESLIE C. LOVE, of Montclair, N. J., and Miss Edith Manson, daughter of Mr. George T. Manson, general superintendent of the Okonite Company, were married in Trinity Church, Montclair, N. J., on April 21. The church was beautifully decorated and the wedding and reception which followed at the bride's home were attended by a large number of representative and prominent men and women from New York, Boston and Montclair.

MR. JAMES L. HALLEY has been appointed general manager of the James Kempster Printing Company, New York city. This is one of the best-known establishments in the city, and has for years handled the publications of a number of corporations interested in the telephone and telegraph and the lighting and power fields, as well as the proceedings of the national electrical engineering associations.

DATES AHEAD.

Nebraska Electrical Trades Association. First annual electrical show, Auditorium, Omaha, Neb., May 4-9.

Illinois State Independent Telephone Association. Annual convention, Champaign, Ill., May.

West Virginia Independent Telephone Association. Annual meeting, Fairmont, W. Va., May 7-9.

Southwestern Electrical and Gas Association. Annual convention, El Paso, Tex., May 7-9.

Railway Signal Association. Next meeting, New York city, May 12.

Grand Rapids Electrical Show Association. First show, Grand Rapids, Mich., May 11-16.

Ohio Society of Mechanical, Electrical and Steam Engineers. Next meeting, Columbus, Ohio, May 15-16.

Indiana Independent Telephone Association. Annual meeting, Indianapolis, Ind., May 20-21.

National Electric Light Association. Annual meeting, Chicago, Ill., May 19-22.

Telephone Association of Texas and Louisiana. Annual meeting, Dallas, Tex., May 25-27.

Oklahoma Electric Light, Railway and Gas Association. Annual meeting, Guthrie, Okla., May 25-27.

Canadian Electrical Association. Annual meeting, Toronto, Ontario, June 10-12.

Society for the Promotion of Engineering Education. Annual meeting, Detroit, Mich., June 22-27.

American Society of Mechanical Engineers. Semi-annual meeting, Detroit, Mich., June 23-26.

American Society of Civil Engineers. Annual meeting, Denver, Col., June 23-26.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 29-July 2.

National Electrical Contractors' Association. Next meeting, Chicago, Ill., July 15-17.

Street Railway Association of the State of New York. Annual meeting, Niagara Falls, N. Y., June 30-July 1.

Michigan Electric Association. Annual meeting Grand Rapids, Mich., August 18-21.

American Society of Municipal Improvements. Annual meeting, Atlantic City, N. J., October.

ELECTRICAL SECURITIES.

The market last week was very active and strong, and the general average of prices made a new high level for the year. Under this rally the market presented its most bullish aspect since last October. It is thought, however, that the rise was largely the result of manipulation, and the generally accepted theory is that at first the advance had the support and co-operation of large financial and banking institutions that were anxious for the market improvement in order to make successful the flotation of many of the recent new security issues. This bull movement developed unexpected strength, and was backed by outside operators until it got beyond the control of the big interests. One reason for this was the unexpectedly large short interest disclosed, a development that resulted in the failure of two large speculative interests. It is not thought that this advance will be held, and a reaction is looked for, as very little has developed to indicate real reasons for the improved condition.

Dividends have been declared upon the following electrical securities: Electric Properties Company; a dividend of 6 per cent covering the period from July 31, 1907, to April 30, 1908, on the preferred stock, payable May 11 to stockholders and subscription receipt holders of record May 4, the above including quarterly dividends Nos. 5, 6 and 7 of 1½ per cent each. Transfer books close May 4 and reopen May 12. United Electric Securities Company; regular semi-annual dividend of 3½ per cent, payable May 1. American Telegraph and Cable Company; quarterly dividend of 1¼ per cent guaranteed by Western Union Telegraph Company, lessee.

ELECTRICAL SECURITIES FOR THE WEEK ENDED MAY 2.

New York:	*Closing.*
Allis-Chalmers common	8⅛
Allis-Chalmers preferred	20¼
Brooklyn Rapid Transit	46¾
Consolidated Gas	120¼
General Electric	134¾
Interborough-Metropolitan common	9⅞
Interborough-Metropolitan preferred	27½
Kings County Electric (ex interest)	118
Mackay Companies (Postal Telegraph and Cables) common	61
Mackay Companies (Postal Telegraph and Cables) preferred	63
Manhattan Elevated	135
Metropolitan Street Railway	25
New York & New Jersey Telephone	105
Western Union	50¾
Westinghouse Manufacturing Company	50¾

The annual meeting of the stockholders of the Interborough Rapid Transit Company will be held on May 13 for the election of five directors to hold office for three years, and to ratify an agreement made with the Manhattan Railway Company dated April 23, 1908. Books close May 2 and reopen May 14.

Boston:	*Closing.*
American Telephone and Telegraph	117¾
Edison Electric Illuminating	210
Massachusetts Electric	—
New England Telephone	113
Western Telephone and Telegraph preferred	65

Philadelphia:	*Closing.*
Electric Company of America	9¾
Electric Storage Battery common	29½
Electric Storage Battery preferred	29½
Philadelphia Electric	8½
Philadelphia Rapid Transit	18
United Gas Improvement	81¾

The annual meeting of the Electric Company of America, in Camden, N. J., was merely a formal affair. During the year there have been three changes in the directorate, as follows: G. B. Roberts, H. S. Kerbaugh and J. E. Hayes, resigned; C. R. Snowden, E. D. C. Catherwood and John B. Morton being elected in their places. Other directors were re-elected.

Chicago.	*Closing.*
Chicago Telephone	118
Commonwealth Edison	90
Metropolitan Elevated preferred	45
National Carbon common	56
National Carbon preferred	109

ELECTRIC LIGHTING.

MILFORD, PA.—It is announced that the Milford council will install an electric lighting system.

WILLIAMSVILLE, N. Y.—The board of trustees has granted O. A. Simon an electric light and power franchise.

AVONDALE, PA.—Avondale has completed a five-year contract for street lighting with the Kennett Electric Light Company.

PASADENA, CAL.—Contracts totaling nearly $9,000 have been let by the city council on the recommendation of Manager Koiner, of the municipal electric light plant.

MIDDLETOWN, CT.—The Middletown Electric Light Company has purchased a plot of ground on which it will erect a modern plant. H. A. Willard is chief engineer.

HAMPSHIRE, ILL.—The municipal electric light plant, installed in 1903 at a cost of $5,000, has been sold by the town for $3,600. The plant has not been a success.

BOSTON, MASS.—The gas commission has authorized the Lowell Electric Light corporation to issue $93,000 in additional stock at $150 per share, proceeds to be used to cancel outstanding notes.

CAMBRIDGE, NEB.—At the annual meeting of the stockholders of the Cambridge Electric Light Company the following officers were elected: R. E. George, president; E. C. Rodwell, vice-president; C. M. Brown, treasurer, and G. Eli Simon, secretary. W. H. Faling, E. C. Rodwell, D. F. Neiswanger, George Williams and R. E. George will constitute the board of directors.

ONEIDA, N. Y.—Within a short time work on an electric light plant at Sylvan Beach will be begun by a company which has leased Carnival Park for a period of fifteen years. The company will use 1,000 incandescent lights in lighting the park, which has been renamed Luna Park, and will also furnish electricity for lighting the entire village of Sylvan Beach.

ALBANY, N. Y.—The Public Service Commission has granted permission to the Genesee County Electric Light, Power and Gas Company, of Batavia, to construct, maintain and operate an electric light plant in the village of Bergen; and has also approved of the transfer of the works and system in the village of Bergen from the administrators of the estate of Bert L. Lewellyn to the company.

TIFFIN, OHIO—The City Heat and Light Company, of Fostoria, has been placed in the hands of receivers on application of the Consolidated Railway and Light Company, of Philadelphia. The application states that the Fostoria company has an indebtedness of $365,000, of which $93,500 is due, with no assets to pay it. E. W. Allen, of Fostoria, and A. R. Law, of Philadelphia, are the receivers.

HAGERSTOWN, MD.—According to the annual report of the Hagerstown municipal electric light plant the streets of the city are lighted all night every night in the year, by 144 arc lights, at a cost of $14.12 per light. This low cost is made possible by reason of the large amount of current sold for commercial light and power purposes, the receipts from this source amounting to about $30,000 a year.

ASBURY PARK, N. J.—At a meeting of the directors of the Atlantic Coast Electric Light Company the following officers were elected: President, S. F. Hazelrigg; treasurer, George B. Cade; secretary, J. G. Campbell. The directors of the Sea Shore Electric Railway Company organized as follows: President, S. F. Hazelrigg; vice-president, C. E. Harris; secretary-treasurer, George B. Cade.

NELSON, B. C.—The city power and light substation was partially destroyed by fire on April 25. The building was occupied jointly by the city, the West Kootenay Power and Light Company and the Nelson Tramway Company. The loss of the West Kootenay company in transformers, switchboards, etc., was $12,000, while the joint loss of the city and the tramway company was $12,000. The loss was covered by insurance.

SKAGWAY, ALASKA—A company of citizens has purchased the plant of the Northwest Light and Power Company for $16,000. This company supplies light and water to the city. It contemplates building a dam at Lake Dewey, on the hill above the city, and diverting the streams into the lake, increasing the water reserve, extending the pipes and otherwise improving the plant so that power may be developed for the sawmills and industries of the city.

OSHKOSH, WIS.—The Little Wolf River Power Company has been incorporated here with a capital of $250,000. The incorporators of the company are the following officers: Leander Choate, president; Casper Faust, vice-president; Frank H. Josslyn, secretary, and E. H. Steiger, treasurer. The company owns four mills on the Little Wolf River in Waupaca County, and will utilize the water power to generate electric current for transmission to Oshkosh.

PHOENIX, ARIZ.—The Maricopa County Commercial Club and the Phoenix Board of Trade, it is understood, are taking steps looking to the annulment of the contract entered into between the United States Government and the Pacific Gas and Electric Company, by which the former is to furnish power exclusively to the power company from the Roosevelt dam during a period of ten years, at a flat charge of one and one-half cents per kilowatt-hour. The contention is that no provision is made in the contract regarding the rate at which the power is to be retailed.

GREENSBORO, N. C.—Captain W. T. Weaver and associates, of Asheville, have purchased from the North Carolina Electric Power Company its power plant on the Ivy River and the potential possibilities on the French Broad, near Marshall and Hot Springs. The enterprise was established by W. B. Ellis and W. A. Lemly, of this city, in 1901-02, and cost over $100,000. Later Ellis disposed of his interest to Messrs. Lemly, J. A. Vance, Postmaster C. A. Reynolds, of this city; Light Brothers, of Walkertown; Colonel J. S. Carr, of Durham, and others.

NEW ALBANY, IND.—The mayor has signed a contract with the United Gas and Electric Company, authorizing it to install in the city a number of new arc street lights to make a test of a new lamp that the company, which has the contract for lighting the city, desires to adopt. It is stipulated in the contract that if at the end of ninety days it is found that the new lamps are not as satisfactory as the old, they are to be removed and the old ones replaced, but if they are satisfactory, the remainder of the old lights in the city are to be removed and replaced by the new ones.

ALBANY, N. Y.—The Public Service Commission of the Second District has authorized the Plattsburgh Light, Heat and Power Company to issue $250,000 thirty-year five per cent bonds, secured by a mortgage to the Standard Trust Company, of New York, upon all of its property. The company is authorized to issue $230,000 of these bonds at the present time. Of the bonds authorized, $65,000 must be sold at not less than ninety, to take up the company's floating indebtedness, while $25,000 must be sold at not less than ninety, to be used in making extensions and improvements to the gas-distributing system.

EAST MOLINE, ILL.—The city council has entered into a twenty-five-year contract with the United Light and Power Company for the lighting of East Moline streets and the driving of the waterworks machinery. The contract sets the rates for the first five years, and provides that at the end of that period a readjustment may be made. The two parties failing to agree on a readjustment, each shall name three towns in Illinois or Iowa of equal size with East Moline. The rates charged these cities for similar services shall be averaged and the prices thus obtained shall be enforced in East Moline, provided, however, that they are not less than the rates in force in Moline.

LAFAYETTE, IND.—The city of Lafayette has just closed a contract with the Merchants' Electric Light Association for lighting the streets, alleys and public buildings for a period of ten years. For the last twenty years the city has been paying $66 per lamp per year, for 2,200 hours of lighting, with 6.6-ampere, direct-current open arc lamps. Under the new contract, which goes into effect September 1, 1908, the company will furnish and light 300 metallic-flame arc lamps, 2,500 hours for $37.98 per lamp per year, and extra lighting at one cent per lamp per hour. This will amount to a saving of about $100,000 to the city in ten years. The engineering work, preparation of specifications and contracts, has been done by J. Walter Esterline, consulting engineer. After complete tests made at the photometric laboratories at Purdue University, the Westinghouse four-ampere, metallic-flame arc lamp has been selected by the board of works.

INDUSTRIAL ITEMS.

THE AMERICAN BANK NOTE COMPANY, New York city, announces its occupancy of new executive offices at 70-72 Broad street.

THE AMERICAN CIRCULAR LOOM COMPANY, Boston, Mass., announces the occupancy of its new offices in the International Trust Building, 45 Milk street.

THE OHIO BRASS COMPANY, Mansfield, Ohio, announces the removal of its New York city office from 43-49 Exchange Place to room 1022 Cortlandt Building, Hudson Terminal.

THE BISHOP GUTTA PERCHA COMPANY, 420-430 East Twenty-fifth street, New York city, manufacturer of insulated wires and cables and gutta-percha goods, has discontinued its Chicago branch office.

THE CASSIER MAGAZINE COMPANY, New York city, publisher of *Cassier's Magazine*, announces the removal of its New York offices from No. 3 West Twenty-ninth street to No. 12 West Thirty-first street.

THE F. BISSELL COMPANY, Toledo, Ohio, is sending its May calendar card to the trade. The company is calling attention to its quotations this month on black locust pins. The quotation must be remarkable because the company makes the following statement: "If we quote, the order's ours."

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., is taking advantage of all cash discounts. This company has so developed its resources that it is in a position to request those with whom it is doing business to indicate on all invoices to the company their largest cash discounts.

THE H. W. JOHNS-MANVILLE COMPANY, 100 William street, New York city, has ready for distribution a booklet devoted to "Magic" boiler compound. The company claims that the "Magic" way is the most practical way of eliminating scale, pitting, corrosion or leakage. Full information will be furnished to those interested upon request.

THE J. LANG ELECTRIC COMPANY, 116-128 Lincoln street, Chicago, Ill., has ready for distribution its general catalogue No. 809, devoted to electrical distributing apparatus. This catalogue is full of good information, and is replete with interesting illustrations of a wide range of distributing material. Copies will be furnished upon request to those interested.

BAKER & COMPANY, INCORPORATED, Newark, N. J., platinum, gold and silver refiners, assayers and smelters, announce the removal of their New York office to the Cortlandt Building of the Hudson Terminal, with entrance at 30 Church street. The company has excellent facilities in its new office to give its friends careful and prompt attention.

THE H. B. KIRKLAND COMPANY, New York city, has been formed and will hereafter act as selling agent for the National Metal Molding Company, with offices at 253 Broadway. Information relating to the well-known products, "Flexduct" flexible conduit and "Economy" rigid conduit, will be furnished upon application. H. B. Kirkland, who is one of the best-known and most admired men in the fraternity, is president of the company, and Charles F. Boynton is treasurer.

THE AMERICAN DISTRICT STEAM COMPANY, Lockport, N. Y., originator of underground steam heating, will have an exhibit at the convention of the National Electric Light Association, Chicago, Ill., May 19-22. This company, with more than thirty-one years of experience, has developed the underground steam-heating business to such a degree of perfection that its exhibit will be worth a thorough investigation. Every detail of the operation of both live and exhaust underground steam-heating systems will be explained by the company's engineers and representatives, who will be in attendance.

THE STANDARD GAUGE MANUFACTURING COMPANY, Syracuse, N. Y., manufacturer of indicating gauges for all purposes, has moved its New York branch from 147 Broadway to room 1770 Hudson Terminal Building. This change was made in order to obtain larger quarters for the display of a wide range of engineering specialties, as well as to remain in the centre of the engineering community. The western branch of the company is located in the Monadnock Building, Chicago, Ill.

THE O. C. WHITE COMPANY, 17 Hermon street, Worcester, Mass., announces the opening of a New York office and stock room at 19 Park Place and 16 Murray street. The company manufactures a very complete line of standard adjustable electric fixtures. This line covers every possible requirement for business purposes, whether in offices, shops, drafting rooms or factories. The New York branch will be in the capable hands of Frederick Rall, who is well known throughout the electrical trade.

GEORGE W. FOWLER & COMPANY, 30 Broad street, New York city, engineers, have recently completed the design of a variable-speed motor, the most interesting feature of which is an arrangement whereby both constant and variable speed may be taken from either end of the same shaft simultaneously. The design of alternating-current and direct-current electrical machinery for any service is one branch of the engineering business to which George W. Fowler & Company devote special attention.

THE BOSTON GEAR WORKS, Norfolk Downs, Mass., has issued two important pieces of literature. The first, circular D-I, is devoted to standard steel miter and bevel gears with generated teeth. These steel gears are carefully designed, special attention having been given to pitch, face, hole and hub. All are of uniform dimensions, and therefore can be safely used in designing new machinery, as each element can be duplicated at any time, thus aiding materially in the standardization of machine parts. Catalogue E-I is a general gear catalogue, including chains, sprockets, bearings, steering devices, etc. The latter catalogue is replete with very interesting information concerning this material.

DOSSERT & COMPANY, 242 West Forty-first street, New York city, have designed a special expansion fitting for their solderless cable taps, which are used as equalizers on the feeder cables supplying power to the Brooklyn Rapid Transit trains which are to run over the new loop connecting the Williamsburg and Brooklyn bridges. The cables vary in size from 2,500,000 circular mils to 500,000 circular mils. The work is under the direction of Latey & Slater, consulting engineers. The Gore Engineering and Contracting Company has placed orders for 244 sets of these large double taps, 164 regular taps, and a number of two-way Dossert joints, including 134 connecting aluminum to copper.

THE GOLDSCHMIDT THERMIT COMPANY, 90 West street, New York city, announces the establishment of an office and works at 103 Richmond street, West, Toronto, Canada. The new branch is under the management of E. C. Rutherford, of Toronto. Mr. Rutherford is a Canadian by birth, and has a wide acquaintance among the business men of the Dominion, having been for several years manager of the Magann Air-Brake Company and of the Canadian Brake and Supply Company. A complete stock of Thermit and appliances will at all times be carried, and the branch organization will be in a position to execute promptly the welding of heavy steel sections. A fully equipped repair shop will be in operation for the repairing of steel castings up to 1,000 pounds in weight.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

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AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis avenue, New York city.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Meetings second Friday of each month. Annual meeting, Atlantic City, N. J., June 29-July 2.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Professor Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Fifty-seventh street, New York city. Annual meeting, Denver, Col., June 23-26.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth street, New York city. Annual meeting, Detroit, Mich., June 23-26.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Park Row Building, New York city. Annual meeting, Atlantic City, N. J., October.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, Elmer M. White, treasurer Birmingham Railway, Light and Power Company, Birmingham, Ala.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. W. Freeman, vice-president and general manager Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, Welles E. Holmes, 308 Washington street, Newton, Mass.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco, Cal.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

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ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water street, Ossining, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Stanley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt street, New York city.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. B. Cheadle, Joliet, Ill. Annual meeting, Champaign, Ill., May.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex. Annual meeting, Dallas, Tex., May 25-27.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. S. Norton, Indianapolis, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ward, Grand Rapids, Mich.; assistant secretary, J. A. Harney, Monadnock Building, Chicago, Ill.

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IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

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MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich. Annual meeting, Grand Rapids, Mich., August 18-21.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MISSOURI STATE ELECTRIC LIGHT ASSOCIATION. Secretary, C. C. Pierson, St. Charles, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George Schweer, Windsor, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee street, Utica, N. Y. Next meeting, Chicago, Ill., July 15.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. W. Freeman, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Annual meeting, Chicago, Ill., May 19-22.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

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OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Ballard, Cleveland, Ohio. Next meeting, Columbus, Ohio, May 15-16.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla. Annual meeting, Guthrie, May 25-27.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city.

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PIKES PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Next meeting, New York city, May 12.

RAILWAY TELEGRAPH SUPERINTENDENTS' ASSOCIATION. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis. Next annual meeting, Montreal, Canada, June 24-26.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex. Annual convention, El Paso, Tex., May 7-9.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW York. Secretary, J. H. Pardee, J. G. White & Company, New York, N. Y. Annual convention, Niagara Falls, N. Y., June 30-July 1.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

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WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

Record of Electrical Patents.

Week of April 28.

885,745. ELECTRIC FURNACE. Paul Girod, Ugine, France. The reducing heat is furnished by refractory material making contact with the bottom and sides of a chamber arranged to receive a plurality of objects to be heated.

885,754. SYSTEM OF ELECTRICAL DISTRIBUTION. Albert S. Hubbard, Greenwich, Ct., assignor to Gould Storage Battery Company. Direct-current dynamos are connected to a plurality of prime movers, effecting the regulation and speed of the same.

885,755. SYSTEM OF ELECTRICAL DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. A counter electromotive-force system for assisting or opposing the effect of low fluctuations.

885,761. PROCESS OF RECOVERING METALS FROM THEIR SULFID ORES. Edward F. Kern, Knoxville, Tenn. An electrolytic process of recovering lead and associated metals from lead sulfid containing ore.

885,769. ELEMENT FOR ELECTRIC HEATERS. Abbot A. Low, Horseshoe, and Harry Hertzberg, New York, N. Y.; said Hertzberg assignor to said Low. Blocks of carbonaceous material are assembled between metallic terminal members and suspended upon a non-combustible core.

885,771. TRANSFORMER-COIL INSULATION. Jesse E. Mateer, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The coils are insulated by means of spaced strips, channel pieces and angle pieces.

885,776. TROLLEY-POLE HEAD. Garret Mott, New York, N. Y., and Adolph G. Koenig, Weehawken, N. J. The swing of the harp is limited to less than a quarter turn in either direction.

885,782. RHEOSTAT. Granville F. Packard, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A subdivided resistance.

885,800. COIL SUPPORT FOR ELECTRIC TRANSFORMERS. Herbert C. Soule, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The coils are supported independently of the other transformer parts.

885,847. ELECTRICAL DISTRIBUTION. John S. Highfield, London, England. A subdivided parallel system of electrical distribution.

885,856. COMBINATION LIGHT REFLECTOR AND DIFFUSER. Harrison D. McFaddin, New York, N. Y. An adjustable combination light reflector and diffuser.

885,859. TELEPHONE STAND. William B. Oliver, Collingswood, N. J., assignor to Oliver Manufacturing Company, Philadelphia, Pa. A combination of switch box and flexible arm.

885,864. ELECTRICAL CONNECTION. Henry R. Read, Brooklyn, N. Y. A helical spring binding wire and terminal post.

885,882. STARTING DEVICE FOR MERCURY LAMPS. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. The lamp is started by a high-potential kick, initiated by an electromagnet affecting a movable member.

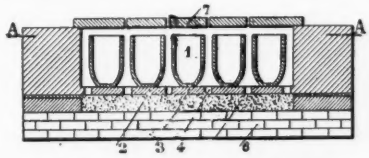
885,890. LAMP SOCKET. William C. Tregoning, Cleveland, Ohio. A self-contained, self-fastening lamp socket for wall recesses.

885,894. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. The circuit is opened when the engine is at rest.

885,906. ELECTRIC ARC LAMP. Heinrich Beck, Frankfort-on-the-Main, Germany, assignor to Beck Flaming Lamp Company, Canton, N. Y. One electrode passes through a continually enlarging aperture, and the other electrode rests upon a shoe.

885,915. BUSY-SIGNAL APPARATUS. Charles J. Erickson, Chicago, Ill., assignor to Automatic Electric Company, Chicago, Ill. A compound buzzer for producing vibrations of relatively high and low rates.

885,922. TELEPHONE SYSTEM FOR FIRE HOSE. Harry Groswith, Philadelphia, Pa. Each length of hose is fitted with an embedded wire, insulated flanges and contact members.



885,745.—ELECTRIC FURNACE.

885,935. RHEOSTAT. Edward L. Mahon, Bellaire, Ohio. An adjustable water rheostat.

885,941. ELEVATOR INDICATING SYSTEM. Charles E. Moore, Los Angeles, Cal. An indicator system showing the direction of travel upon each floor of a multiple-story building.

885,942. SAFETY FLASHLIGHT APPARATUS FOR ELEVATORS. Charles E. Moore, Los Angeles, Cal. A safety flashlight is thrown into circuit automatically when the lever is thrown to stop the car.

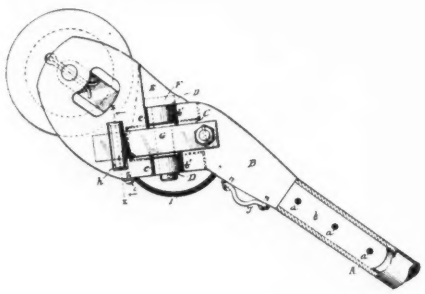
885,953. ELECTRICAL ATTACHMENT FOR CLOCKS. Owen P. Ragan, Ridgeway, Mo. Electrical circuits are closed by means of arbors fastened to the hands at the rear of the clock.

885,967. ELECTRIC CONTROLLER. Reuben I. Wright, Cleveland, Ohio, assignor to Electric Controller and Supply Company, Cleveland, Ohio. Separable contact fingers are pivoted in insulating sleeves mounted upon a metallic bar.

885,988. DUPLEX MOTOR-CONTROL SYSTEM. Fred R. Fishback, Cleveland, Ohio, assignor to the Electric Controller and Supply Company, Cleveland, Ohio. A master switch controlling magnetic switches for operating a motor-control system.

886,031. TOLL TELEPHONE SYSTEM. Edward P. Baird, Evanston, Ill., assignor to Baird Manufacturing Company, Chicago, Ill. The exchange operator controls the coin-refunding means.

886,035. DIRECT-CURRENT TURBO-GENERATOR. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. The armature coils and the commutator are held in position on the spindle by a shrink ring.



885,776.—TROLLEY-POLE HEAD.

886,049. MULTIPLE-VOLTAGE SYSTEM OF DISTRIBUTION. Budd Frankenfield, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. The balancer is first connected to the main conductors and then to a compensating conductor.

886,073. COOLING SYSTEM FOR ELECTRIC APPARATUS. Karl C. Randall, Edgewood Park, and Charles B. Gibson, Wilkinsburg, Pa., assignors to Westinghouse Electric and Manufacturing Company. The reservoirs are equipped with cooling coils.

886,093. CONTACT-POST SYSTEM FOR TRANSMITTING ELECTRIC POWER. George E. Titcomb, Philadelphia, Pa., assignor to Dodge Coal Storage Company, Naugatuck, Ct. A multiple subway conductor system.

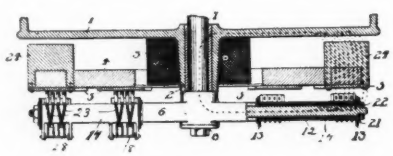
886,109. FIELD-ADJUSTING DEVICE FOR ELECTRIC GENERATORS AND MOTORS. Frederick O. Ball, North Plainfield, N. J. The field frame is connected with the pedestals by adjustable screws.

886,135. WATTMETER-TESTING APPARATUS. Otto A. Knopp, Oakland, Cal. A two-point switch makes connection between the standard resistance unit and the measuring instruments.

886,138. ELECTRIC IGNITER. John N. Lansinger, Kent, Ohio. A portable igniter for causing an electric spark.

886,141. INTERRUPTER. August R. Luschka, River Forest, Ill., assignor to Western Electric Company, Chicago, Ill. A pole-changer and magnetic interrupter.

886,148. SIGNALING DEVICE FOR INCUBATORS. Georg Mücke, Reisenberg, Austria-Hungary. A thermostatic alarm device.



885,967.—ELECTRIC CONTROLLER.

886,157. ELECTRICALLY OPERATED CLOCK. Dominic Sandretto, Ladd, Ill. As the magnet is alternately energized and de-energized, a reciprocating movement engages with the clock pinions.

886,169. MEANS FOR ESTABLISHING ELECTRICAL COMMUNICATION WITH MOVING TRAINS. Joel Ames, Montrose, Iowa, assignor of one-half to Edward Leech, Montrose, Iowa. A shoe carried by a moving train makes contact with suitable terminals.

886,176. TROLLEY HARP. Percy C. Bliven, Danielson, Ct. A locking trolley harp makes the wheel removable.

886,179. AUTOMATIC ELECTRIC COTTON CHOPPER. David R. Bragunier and Alford B. Thompson, Columbia, Ala. An electrically operated catch mechanism controls the chopping blade.

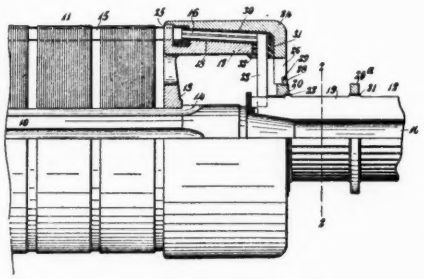
886,220. REGISTERING TELEPHONE CALLS. Isidor Kitsee, Philadelphia, Pa. A step-by-step magnet control registering device.

886,225. CURRENT-DISTRIBUTING DEVICE FOR IGNITING EXPLOSIVE ENGINES. Henri de La Valette, Paris, France. A combination of a spark plug, brushes and contact pieces on a rotating disc.

886,230. RHEOSTAT. John W. Mertz, Mount Clemens, Mich. A bus-bar and switches for making combinations of contacts.

886,239. TROLLEY WHEEL. William W. Neighbour, Denison, Tex. The metal conducting rim of the wheel makes a sliding contact with the pole conductor.

886,246. COOLING SYSTEM FOR TRANSFORMERS. Karl C. Randall, Edgewood Park, Pa., assignor to Westinghouse Electric and Manufacturing Company. Cooling coils and means are provided for automatically regulating the rate of circulation through the tanks.

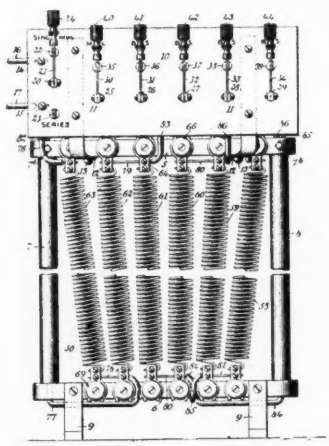


886,035.—DIRECT-CURRENT TURBO-GENERATOR.

886,262. SWITCH-CORD PLUG. Eugene L. Smith, Oak Cliff, Tex., assignor of two-thirds to George F. Childress, Wills Point, Tex. The switch-cord plug is equipped with a ball-and-socket joint.

886,267. MEANS FOR SUPPORTING LAMP RECEPTACLES. James S. Stewart, New York, N. Y., assignor to Annie Stewart, New York, N. Y. A separable means for attaching a lamp socket to a structure.

886,269. RAILROAD DANGER SIGNALING AND TELEPHONING APPARATUS. Edward Sughroue, Bartley, Neb. A combination of a pyrotechnic signaling device, means for firing the same, an engine-stop, and a manually controlled electric circuit for simultaneously actuating the said means and a stop from a distant point.



886,230.—RHEOSTAT.

886,294. ELECTRICALLY CONTROLLED FEED MECHANISM. Bengt M. W. Hanson, Hartford, Ct., assignor to Pratt & Whitney Company, Hartford, Ct. The electric circuit withdraws the feeding mechanism when a predetermined contact point is reached.

886,302. COMBINED TUNING-COIL AND CONDENSER. Walter W. Massie, Providence, R. I., assignor to Massie Wireless Telegraph Company, Providence, R. I. An adjustable inductance and capacity.

886,303. SPARK-GAP APPARATUS. Walter W. Massie, Providence, R. I., assignor to Masssie Wireless Telegraph Company, Providence, R. I. The spark-gap wheel rotates in an air chamber, and the spark-gap rods are enclosed by inlets leading from the chamber.

886,319. SUPPORT FOR ELECTRIC CONTACT-SHOES. Ed. W. Farnham, Chicago, Ill., assignor to Allen G. Mills, Chicago, Ill. A spring-equalized contact for under-running conductors.